

**NAVY**  
**OCCUPATIONAL SAFETY AND HEALTH**  
**(NAVOSH)**  
**PROGRAM MANUAL**  
**FOR FORCES AFLOAT**



**OPNAV INSTRUCTION 5100.19C**  
**VOLUME III**  
**SUBMARINE SAFETY STANDARDS**

**DEPARTMENT OF THE NAVY**  
**OFFICE OF THE CHIEF OF NAVAL OPERATIONS**



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DEPARTMENT OF THE NAVY  
OFFICE OF THE CHIEF OF NAVAL OPERATIONS  
WASHINGTON, DC 20350-2000

IN REPLY REFER TO

OPNAVINST 5100.19C  
N45  
19 JAN 1994

OPNAV INSTRUCTION 5100.19C, VOLUME III

From: Chief of Naval Operations

Subj: NAVY OCCUPATIONAL SAFETY AND HEALTH (NAVOSH) PROGRAM  
MANUAL FOR FORCES AFLOAT, VOLUME III

Encl: (1) Navy Occupational Safety and Health Program Manual for  
Forces Afloat, Volume III

1. Purpose. To provide the third volume of the Navy  
Occupational Safety and Health Program Manual for Forces Afloat.

2. Discussion

a. This volume provides the submarine safety standards and  
precautions necessary to carry out the program established in  
Volume I.

b. To aid in determining changes made from OPNAVINST  
5100.19B, paragraphs which have been modified, added or, deleted  
are appropriately marked.

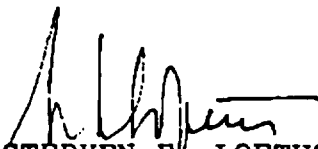
3. Action

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b. Each command should have sufficient copies enclosure (1)  
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4. Forms. The following forms may be ordered from the Navy  
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STEPHEN F. LOFTUS  
Deputy Chief of Naval  
Operations (Logistics)

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## Section D

### SUBMARINE SAFETY STANDARDS

This section contains basic safety requirements that are applicable to submarine operations and/or equipment, and is addressed to the individual deckplate sailor and his supervisor. It may be necessary when conducting operations and maintenance on specific systems or equipments to consult other Navy publications such as the Naval Ships Technical Manual, Naval Warfare Publications, Standard Submarine Organization and Regulations Manual (SSORM), Ship's Systems Manual, Standard Operating Procedures (SOPs), technical/operating manuals, and equipment Planned Maintenance System (PMS) cards for complete safety procedures. It must be recognized that there may be conditions that are not covered in this manual. If a NAVOSH standard does not exist, the Type Commander shall be notified via the chain of command. The Type Commander considering the chain of command input will determine if there is an applicable OSHA standard and how the OSHA standard shall apply considering if there are military unique requirements/design configurations that prevent compliance with OSHA standards. The Type Commander or other commander in the chain of command, if knowledgeable, shall provide guidance to all ships under his command as to the standards to be followed.

CHAPTER D1

BASIC SAFETY

D0101. DISCUSSION

a. Shipboard life is one of the more hazardous working and living environments that exist. The existence of hazardous materials and equipment, in addition to the fact that a ship is a constantly moving platform subject to conditions such as weather, collision, and grounding contribute to an accident-prone environment. Any chain of mishaps could lead to a major catastrophe. It is for this reason, PRACTICAL SAFETY must be followed and the prescribed safety regulations strictly followed to prevent personal injury and illness.

b. The general safety standards in the following section are applicable to all shipboard operations and spaces.

D0102. GENERAL SAFETY STANDARDS

Complying with the following standards may save your life:

- a. Locate and remember all exits from working and living spaces.
- b. Know where life jackets and Steinke hoods are stored.
- c. Make sure that all movable objects are properly secured for sea.
- d. Always wear clothing that snugly fits your body.
- e. Whenever practicable, carry a load in a manner which allows one hand to be free.
- f. Always move up or down a ladder with one hand on the railing.
- g. Know the emergency shut-down procedures for all equipment you operate.
- h. Always ensure exits are not blocked with equipment or boxes.
- i. Always ensure ventilation ducts are free of blockage.
- j. Never horseplay on board ship.
- k. Rings, watches, key rings, and other items that may become entangled or caught on projections should not be worn.
- l. Always wear approved safety shoes when required by the job.

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- m. Carry as little in your pockets as possible.
- n. Walk, don't run in passageways.
- o. Always be cautious when nearing a "blind" corner.
- p. Know the location of submarine escape equipment for all escape stations and know how to conduct an escape from each escape station.
- q. Know the location of all fire stations and other firefighting equipment throughout the ship.
- r. Keep constantly familiar with the whereabouts of crew members in the space where you are working, especially if they are working in tanks or other restricted movement areas.
- s. Smoke only in designated areas.
- t. Equipment shall be operated only by authorized personnel and in an authorized manner.
- u. Sunglasses shall only be worn topside.
- v. If you pass through a watertight door designated to be closed during normal operations, be certain that it is properly closed.
- w. Know where life rings, watermarkers, and flares are located for man overboard emergencies.
- x. Know all areas where protective equipment should be worn.
- y. Promptly inform senior personnel responsible for a given space or equipment of all unsafe conditions discovered.
- z. Do not lean against lifelines.
- aa. Keep decks free of obstacles and materials causing slippery conditions, particularly in work areas. Areas that are slippery shall be posted with a warning sign.
- ab. Provide temporary protection by guardrails or chains, suitably supported by stanchions or pads, when opening accesses in bulkheads or decks which are normally closed.
- ac. Never straddle or step over lines, wire, and chains under tension.
- ad. After opening and prior to passing through a watertight door, hatch, scuttle, or manhole cover, ensure hatch brace pins and/or safety pawls and scuttle/manhole covers are positively locked.

ae. Wear an inherently buoyant life-jacket or auto-inflatable utility life preserver (AIULP) and approved topside shoes topside where the potential exists of falling, slipping, being thrown, or carried into the water. Safety harnesses shall be worn by all personnel on the main deck while underway, except during the maneuvering watch, or unless otherwise specified by the commanding officer. (R)

af. Never dismantle or remove any lifeline, or hang or secure any weight or line to any lifeline except as authorized by the commanding officer.

ag. Never dismantle or remove any inclined or vertical ladder without permission of the commanding officer. Such areas shall be secured with temporary lifelines and shall be posted with a warning sign.

ah. Never operate machinery or equipment with defective safety devices.

ai. Never tamper with or render ineffective any safety device, interlock, ground strap or similar device intended to protect operators or the equipment without specific approval of the commanding officer.

aj. Never open or close electrical switches and pipe valves unless authorized to do so.

ak. Ensure that low overheads above inclined ladders (72") and passageways (75") and obstructions in passageways are padded, and hazardous areas around machinery are color-coded to warn people of danger areas.

al. Only enter tanks and/or voids that have been checked by a gas free engineer and the results posted at the entrance. (A)

am. Never tamper with any damage control or rig for dive fittings or equipment. (A)

an. Portable stereo earphones shall not be worn while performing work aboard ship or while transiting throughout the ship. Wear portable stereo earphones only while in your rack, recreation/study areas, or in the berthing spaces. (A)

#### D0103. TRAINING

a. While most of the standards specified in this chapter are covered during basic training, Submarine School, and at specific training schools, a new crew member, upon reporting on board, should be given a brief orientation as to their intent and importance and where they may be found aboard ship.

b. Every time a mishap occurs involving a violation of one of these standards, all personnel should have the appropriate standard again brought to their attention. This can be accomplished through the use of Plan of the Day notes, divisional training, or quarters.

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A) D0104. EMERGENCY RESPONSE EQUIPMENT

a. Ensure all emergency response equipment is complete and in good repair.

b. Stow emergency response equipment in a location affording quick, easy access.

## CHAPTER D2

### STORES HANDLING/RIGGING

#### D0201. DISCUSSION

a. Stores are any material that are carried in their own container and are not in bulk form, such as fuel. Examples of stores are provisions and supplies that are carried aboard submarines.

b. Stores handling evolutions are hazardous even though they appear routine. Stores being handled can fall or shift, causing injury to personnel and damage to the ship. Additionally, hazardous material that is damaged while being handled can cause illness or death in extreme conditions. Stores handling gear can fail, causing not only stores damage, but also the handling gear itself can maim or even kill, as well as cause physical damage. It is for these reasons that care must be used during stores handling operations.

c. This chapter is written from the standpoint that a submarine would be the receiver of stores. Such stores may be received from a tender or from the shore through the use of cranes or other lift equipment.

d. Submarines are required to perform some rigging operations for the removal of or installation of equipment. Rigging aboard submarines will frequently involve the use of chainfalls and come-a-longs and may involve the use of the ship's davit.

#### D0202. STORES HANDLING PRECAUTIONS

The following precautions should be followed during stores handling operations:

a. When using the ship's davit for stores handling, use correct and well-maintained blocks and sheaves for safe load handling operations. The following procedures and safety precautions shall be observed at all times:

(1) Ensure the SAFE WORKING LOAD is stamped on each block and on the davit. A test label plate showing test data, facility conducting test, and date of test should be located on the davit.

(2) Before use, inspect blocks and sheaves for defects. Sheaves with corrugated grooves, chips, or excessive wear and blocks with damaged shells, straps, swivels, shackles, eyes, or excessive wear shall not be used. (R

(3) Know the load capacity of hooks and ensure that such capacity is not exceeded. Test all hooks for which no applicable manufacturer's recommendations are available at twice the intended safe working load before initially putting into use. Maintain a record of the dates and results of such tests. Inspect hooks periodically to see that they have not been bent by overloading. Do not use bent or sprung hooks. Visually inspect hooks before lifting the rated load.

- (4) Use safety hooks fitted with a safety latch or mouse the hook.
- (5) Keep hands safely away from a hook until clearance is given to hook or unhook. Be especially careful to keep clear of swinging hooks.
- (6) Set hooks firmly in place before making a lift. Never carry a load on the point of a hook.

b. When stores are being put aboard ship, using a crane:

- (1) Always know where the cargo is during a transfer.
- (2) Wear a hardhat with chin strap in place under the chin, gloves when handling wire rope or banding material, and safety shoes.
- (3) Never walk under suspended cargo.
- (4) When stores are being lowered, keep feet and hands clear.
- (5) Never put hands under cargo during transfer.

R) c. When loading stores by hand in the area of crane operations, personnel topside shall wear approved hard hats and safety shoes.

- d. Know firefighting and safety equipment locations.
- e. Do not walk backwards.
- f. If wearing glasses, ensure they are shatter proof.
- g. Never throw anything down a hatch or onto a dock.
- h. Do not smoke.
- i. Inform supervisors of unsafe conditions.
- j. Do not ride on conveyors.
- k. Wear faceshields or goggles and gloves when removing steel strapping. Have personnel in the area stand to one side or out of the path the strapping will follow when cut.

l. Always brace, shore, and lash stores that may shift.

**D0203. CHAINFALLS AND COME-A-LONGS**

- a. Do not exceed weight for which the equipment was designed.

- b. Never kink, twist, or knot chains or slings, as these are among the greatest causes of failures.
- c. Never splice or shorten chains by bolting, wiring, or knotting.
- d. Clearly mark chainfalls and come-a-longs to show the capacity. Do not exceed marked capacity.
- e. Do not use chain, whether new, repaired, or to which hooks or rings have been added, without thoroughly inspecting or weight testing, if required. Tag defective chains or slings or immediately cut up and do not allow to lie around the work station.
- f. Do not subject chains to sudden shock while in use. Jerky movements put severe strains on the chain.
- g. Keep chains free from grit and dirt. Do not drag chains or drop them on hard materials.
- h. Use attachments or fittings for chains of the type, grade, and size suitable for service with the size of chain used.
- i. Keep brakes free from grease, oil, and rust. Adjust for wear as required.
- j. Do not operate unless the ratchet and pawl mechanism is engaged.
- k. Keep the equipment dry and rust-free. Lubricate only the load chain.

## CHAPTER D3

### WIRE AND FIBER ROPE

#### D0301. DISCUSSION

Ropes come in a multitude of types, quality, and sizes, each with its own characteristics. In general, there are two types of rope: fiber (natural and synthetic) and wire. When removed from a coil or reel, fiber ropes are generally referred to as lines. Wire is referred to as "wire rope" or "wire," but not "cable." Each of these ropes have been developed to satisfy a specific requirement. They can be safely used, but must be properly maintained.

#### D0302. GENERAL PRECAUTIONS

- a. Always inspect wires and lines before use. Look for deterioration, broken wires or fibers, visible signs of rot, chafing, variations in color, crushing, or other signs of damage. Refer to Naval Ships Technical Manual (NSTM) Chapter 613, Wire and Fiber Ropes and Rigging, for additional information on use, maintenance, and material requirements for ropes.
- b. Wear topside shoes with skid-proof soles before handling lines. When handling lines, do not wear rings, watches, key rings, and other items that may become entangled.
- c. Check and test capstans to ensure they are operating satisfactorily. (R)
- d. Avoid getting hands, feet, or clothing caught in bights formed by lines.
- e. Do not stand directly in line with the point where (around a bitt, capstan, or through a block) lines change direction.
- f. Do not straddle or stand on wires or lines, whether under tension or not.
- g. Avoid placing wires or lines on rough or sharp surfaces that can cause chafing or cutting.
- h. Do not place objects on wires or lines.
- i. Ensure all kinks are out of wires or lines before use.
- j. Ensure sheaves and blocks being used are of proper size and strength. (R)
- k. Listen to lines under tension. Any unusual popping or tearing noises may mean that the line is in danger of failing.

- l. Always place hands above lines fairled into capstans or bitts.
- m. Do not lubricate lines.
- n. Do not apply loads suddenly.
- o. Never leave wires or lines under strain on capstans.
- p. Do not use sheaves with corrugated grooves.
- q. Remove the loose ends of splices.
- r. Seize all bitter ends.
- s. Do not use manila, wire, spring-lay rope, or synthetic line together on the same chock or bitt.
- t. Carefully make up lines not in use.
- u. Do not permit rat guards and sharp edges to wear mooring lines. Use chafing gear and lash well.
- v. Change mooring lines in accordance with PMS procedures. Failure to make such changes can result in serious injury.
- w. Ensure wires, lines, and rigging are not subject to overload.

D0303. SYNTHETIC LINES

In addition to the precautions in paragraph D0302, the following precautions shall be observed:

- a. Do not expose lines unnecessarily to heat, sunlight, excessive cold, or chemicals.
- b. Always thaw frozen lines before use.
- c. Install tattletale lines to gauge how much mooring lines are stretching.
- d. Payout lines on cleats, bitts, or capstans slowly. Exercise extreme care when easing out synthetic lines under heavy load. Because of their high extendibility under load, their rapid recovery, and their low coefficient of friction, these ropes may slip suddenly on easing out, thereby causing injury to line handlers. For control in easing out or surging, take two round turns on the bitts and then apply one or two figure eight bends. No more than two figure eight bends shall be used. Because these bends tend to lock under surge, use of more than two figure eight bends will cause difficulty in easing out operations.

- e. Double-up lines under excessive strain.
- f. Never use wire or chain stoppers on fiber lines.

R)

g. Stand clear of lines under strain. (The videotape "Synthetic Line Snapback" or SOBT video #4 on "Submarine Line Handling" should be viewed for an appreciation of this phenomenon.)

**D0304. WIRE ROPE**

In addition to paragraph D0302, the following precautions shall be observed:

- a. Always wear heavy duty gloves when handling wire rope.
- b. Always wear goggles while splicing.
- c. Seize wire ends to prevent unlaying.
- d. Store wire rope away from weather, acid, and chemicals.
- e. Inspect wire rope in accordance with PMS procedures.
- f. When using U-bolt clamps to form an eye, always put the U-bolt itself over the bitter end. Tighten clamps only after putting line under stress.
- g. Do not use sheaves or blocks designed for use with fiber rope with wire rope.
- h. Inspect end fittings, such as sockets, connectors, and wire rope clips prior to use, to determine if there is an area of break adjacent to the fitting. Tighten clips after the first hour of running and at PMS specified intervals thereafter. Remove clips after long use and examine rope for broken wires. Remove the damaged part, if broken wires are found, and make a new attachment.

CHAPTER D4

WORKING OVER THE SIDE, TOPSIDE, OR ALOFT; DRYDOCK SAFETY

D0401. DISCUSSION

a. Since many areas on the exterior of a ship are inaccessible to the crew, it becomes necessary to go "over the side" or "aloft" to reach these areas. "Over the side" shall be defined as anywhere outboard of the lifelines. "Aloft" shall be defined as either work on or within the sail.

b. The greatest hazards associated with working over the side, topside, or aloft are the potential for slipping and/or falling. Other hazards include the dropping of objects on (or by) personnel and radiation burns.

c. When a ship is in drydock, many of the precautions associated with working over the side, topside, or aloft must be followed. This chapter will discuss the hazards and precautions associated with this unique evolution.

d. Additional precautions for working over the side, working topside, working aloft, and drydock safety are found in references D4-1 and D4-2.

D0402. GENERAL PRECAUTIONS

a. Wear a parachute type safety harness with Dyna-Brake<sup>®</sup> safety lanyard, working lanyard and tending line (as required) with double-locking snap hooks. The harness shall be inspected in accordance with established PMS prior to use.

b. Attach safety lanyards to all tools, if practicable. Rig a line and raise/lower tools to the work area in a bucket.

c. When underway, the commanding officer's permission is required to work over the side, topside, or aloft.

d. An experienced senior person shall check any rigging or staging prior to use. Never rig lines over sharp edges. Inspect lines for damage, rot, and wear. Secure lanyards to solid structures.

e. The petty officer in charge shall mark off the work area and keep unnecessary personnel clear. He shall also maintain a sharp lookout for anything that would cause an increase in ship's motion. If the slightest chance of collision exists, personnel shall be moved to safety.

f. Read any safety placards posted in the area prior to commencing work. Submarines shall rig temporary safety placards during hazardous evolutions topside.

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g. Cranes used to suspend personnel over the side shall be certified and man-baskets shall be approved by COMNAVSEASYS COM as safe for manned handling. Comply with the caution plates attached to the inside and outside of the man-basket gate.

**D0403. ADDITIONAL PRECAUTIONS FOR WORKING OVER THE SIDE OR TOPSIDE**

a. Wear an inherently buoyant lifejacket modified with a button hole in the back for concurrent use with the parachute type safety harness and wear a hardhat with chin strap when working over the side.

b. Each person working over the side shall have an assistant to tend lines.

c. Secure the ship's propeller and overboard discharges in the area of personnel working over the side.

d. Only perform work between ships or between a ship and dock with a camel in place.

e. Perform work over the side with the ship in drydock only with the commanding officer's permission.

f. Ensure that a safety line is attached to all power tools (electrical or pneumatic) prior to use topside or over the side.

g. Personnel shall keep clear of all shore power cables and high pressure lines.

**D0404. PERSONNEL WORKING ON OR WITHIN THE SAIL**

a. Do not go aloft without first obtaining permission from the duty officer.

R) b. Prior to commencement of work and every 30 minutes thereafter, pass a verbal warning over the 1 MC, "THERE ARE MEN WORKING IN THE SAIL. DO NOT RAISE, LOWER, ROTATE OR RADIATE FROM ANY MAST OR ANTENNA, DO NOT SOUND THE SHIP'S WHISTLE. DO NOT CYCLE THE FAIRWATER PLANES; THERE ARE MEN WORKING IN THE SAIL." Upon completion of the work, pass on the 1 MC, "THE SAIL IS CLEAR."

c. All radio transmitters and the radar shall be placed in the STANDBY position.

d. Ensure that a safety line is attached to all tools prior to use on or in the sail.

e. Ensure that the safety harness is attached to the sail safety fitting (if provided).

**D0405. DRYDOCK SAFETY PRECAUTIONS**

- a. Personnel working over the side in the drydock shall comply with the precautions indicated in this chapter with the exception that life jackets are not required in drydocks without water. Personnel working over the side in drydock will normally be in a man basket with safety harness and Dyna-Brake<sup>®</sup> worn. On scaffolding with guard rails, no safety harness is required. (R)
- b. Ensure all staging is adequately constructed and supported.
- c. Only enter the dock with a hard hat and safety shoes. (R)
- d. Shift no weights within the ship while in drydock without the permission of the docking officer.
- e. Ensure the ship is adequately grounded at all times.
- f. Drain all lines subject to freezing, in freezing weather. If frequent service is required, maintain a small flow through the line to prevent freezing.
- g. Ensure adequate topside lighting is provided by either installed dock lights or by temporary lighting, particularly in areas where normal passage is obstructed or disrupted by service lines or work in progress.
- h. Ensure that any equipment which projects through the hull is operated only with the permission of the commanding officer and then with a safety observer outside the hull.
- i. Do not permit horseplay, leaning on lifelines or other negligent practices leading to falling over the side.
- j. Do not throw anything over the side into the dock, including debris from cleaning or preservation. (R)
- k. When carrying fuel of any kind in drydock, do not allow fuel to drain into the dock. Should it be necessary to remove any fuel from tanks while in drydock, take precautions which will prevent any of the fuel from reaching the floor of the dock.
- l. Safety nets shall be rigged extending a minimum of 6 feet on both sides under all access brows between the ship and the dock apron. (R)

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## Chapter D4

### REFERENCES

- D4-1 COMSUBLANT, COMSUBPAC Instruction 5400.38, "Standard Submarine Organization and Regulations Manual (SSBN)"
- D4-2 COMSUBLANT, COMSUBPAC Instruction 5400.39, "Standard Submarine Organization and Regulations Manual (SSN)"

## CHAPTER D5

### ELECTRICAL AND ELECTRONIC SAFETY AND TAG-OUT PRECAUTIONS

#### D0501. DISCUSSION

a. Practically every piece of equipment on board ship requires electrical power. Radars, communication equipment, as well as lighting, portable tools, and personal equipment, all use power from the ship.

b. The fact that electrical equipment and tools are so commonplace means that hazards involved with electricity are often taken for granted. This is despite the fact that the hazards of electrical shock are commonplace ashore where the extra shipboard hazards of high-powered equipment, unstable work spaces, and saltwater are usually non-existent. Compared to other environments, the potential for electrical shock aboard ship is increased. Although ships' electrical/electronic systems are ungrounded, personnel and equipment may easily become a path to ground in cases of faulty wiring, resulting in injury or death or damage to equipment.

c. Refer to Naval Ships Technical Manual (NSTM) Chapter 300, Electric Plant General, for further guidance.

#### D0502. DEFINITIONS

a. "Electrical equipment" shall include generators, electrically-powered machinery and mechanisms, power cables, controllers, transformers, and associated equipment.

b. "Electronic equipment" shall include radars, sonars, radios, power amplifiers, antennas, electronic warfare equipment, computers, and associated controls and peripherals.

#### D0503. ELECTRICAL PRECAUTIONS

a. Do not touch a conductor, until it is tested to be sure it is de-energized.

b. Obey all warning signs; read equipment warning labels before use.

c. Never work on live (energized) electrical equipment without the commanding officer's permission and only in accordance with NSTM, Chapter 300.

d. Always de-energize and "tag-out" with red "DANGER, DO NOT OPERATE" tags, installed electrical equipment before starting any maintenance or repair.

e. Do not energize any equipment that is tagged-out. Properly clear the tag first.

- f. Only use authorized equipment.
  - g. Close all fuse boxes, junction boxes, switch boxes, and wiring accessories.
  - h. Ground all metal-cased electrical equipment, except double insulated.
  - i. Never operate a switch with the other hand on a metal surface.
  - j. Do not use equipment with worn or damaged cords, or crushed or damaged plugs. They are not to be patched with electrical tape.
  - k. Never use outlets that appear to be burnt.
  - l. When using a metal-cased tool, ensure it is equipped with a three conductor cord and three-pronged plug.
- R) m. Wear approved and certified electrical gloves when using metal-cased portable electric equipment, or when using electric handheld portable tools in hazardous conditions, wet decks, and bilge areas. Leather gloves shall be worn over electrical gloves when the work being done could damage the electrical gloves.
- R) n. Check that portable electric equipment and extension cords have been inspected and have a current electrical safety check tag affixed before use.
- o. Only use electric equipment in explosive atmospheres if the equipment is approved for such use (explosion proof).
- p. Ensure that "dead-man" switches work properly when installed.
- R) q. Do not allow cords to run through hatches, scuttles, water-tight doors, or chemicals, or over sharp objects or hot surfaces.
- r. Do not join more than two 25-foot extension cords together.
- s. Use a voltage meter to test whether equipment or circuits are energized.
- t. Never remove overload relays except for replacement or preventive maintenance.
- u. Use all safety precautions in NSTM, Chapter 300 when working on energized circuits or equipment.
- R) v. Use skin and eye protection when working with wet cell batteries.
- w. When using portable electric devices connected to extension cords, plug the device into the extension cord before the extension cord is inserted

into a live bulkhead receptacle. Likewise, unplug the extension cord from the bulkhead receptacle before the device is unplugged from the extension cord.

x. Do not allow cords to kink, nor be left where they might be damaged by vehicle/foot traffic. When it is necessary to run electrical leads through doors or hatches, protect the cord to guard against accidental closing of the door or hatch.

y. Return portable electrical power tools, drop cords, and extension cords, after use to the proper location to prevent damage to the equipment.

z. Elevate cords extending through passageways so they do not become a tripping hazard or interfere with safe passage.

aa. Visually inspect portable cables, such as shore power "pigtailed", for any sign of an unsatisfactory condition, such as tears, chafing, exposed insulated conductors, and damaged plugs and receptacles. Cables shall be of the proper length and cross-sectional area. Do not use spliced portable cables except in emergency conditions, as outlined in Naval Ships Technical Manual, Chapter 300, paragraph 300-4.6.8. (R)

ab. Use only COMNAVSEASYSCOM-authorized extension lights for shipboard use in order to eliminate or drastically reduce the many hazards associated with the use of unauthorized commercial grade lights.

#### D0504. BATTERIES

##### a. Main Storage Batteries

(1) Observe the following safety precautions when working in the battery well:

#### WARNING

Remove all metal from body and pockets.

(a) Do not enter the battery well while a charge is in progress.

(b) Never work alone in the battery well except when performing daily gravity checks. (R)

(c) Make no repairs to battery storage connectors when battery current is flowing.

(d) Measure battery ground resistance prior to any work which involves the battery well. Insulate the body from ground by using a rubber sheet.

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(e) Use only insulated tools and non metallic flashlights in the battery well. Be very careful never to short circuit any part of the battery. Appropriate precautions should be taken (i.e., insulated carrying tray) to ensure that no tools or equipment are dropped between battery cells.

(f) Tools used in the battery well shall be shorter than the distance between metal terminals, when practical.

(g) Ground detectors should never be used with personnel inside the battery well due to the possibly of electrical shock.

(h) Keep cell service openings closed except when they must be opened to take readings or add water.

(i) Keep cell tops clean.

(j) Never stow loose gear in the battery well. Gear such as cleaning rags, hydrometer boxes, pieces of wire, and tools must be removed immediately after use.

(k) Station a fire watch in the battery well whenever hot work is being performed at a well boundary. Have an insulated CO<sub>2</sub> fire extinguisher available for minor fires. Two insulated CO<sub>2</sub> fire extinguishers should be mounted near the battery well.

(2) The charging of batteries will produce hydrogen gas which may be ignited causing fire and explosion. Keep the battery well properly ventilated during charging.

(3) Post a warning placard at the storage battery well access while battery charging is in progress.

(4) Hydrogen is evolved from lead acid batteries during discharge, stand, or charge, and therefore must be continuously ventilated.

(5) Hydrogen detectors must be operated continuously with readings taken at either 15- or 30-minute intervals, depending on the voltage or charging rate. See NSTM chapter 223, volume I, paragraph 223-3.61 for details.

(6) Do not pour water into concentrated sulfuric acid. The heat generated will cause a violent reaction. Sulfuric acid is highly corrosive. Wash up spillage with water and sodium bicarbonate. When handling acid or electrolyte, always wear a rubber apron, rubber boots, rubber gloves, chemical goggles, and a face shield. Know locations of nearest emergency eyewash station.

R) (7) Do not charge a battery for which the resistance is less than 100,000 ohms.

(8) Add to the battery only pure distilled water or water that analysis has found to be pure enough for battery use. Do not use the battery watering hose for any other purpose.

(9) Refer to Naval Ships Technical Manual, Chapter 223 and applicable technical manual for battery charging and maintenance procedures.

(10) While charging batteries, pass the word per Standard Operating Procedures.

b. Equipment Batteries

(1) Mercury batteries shall not be used in nuclear submarines without approval of COMNAVSEASYSCOM.

(2) Lithium batteries shall not be used aboard ship without specific approval of COMNAVSEASYSCOM.

(3) Primary batteries, especially mercury and lithium batteries, shall never be punctured, incinerated or recharged.

(4) Dispose of mercury and lithium batteries promptly as hazardous waste. Mercury cell batteries shall be disposed of at the first shore installation. Lithium batteries shall not be stored at sea for shore disposal, but shall be disposed of in water over 600 feet deep per Chapter B3 of this manual. Ashore, dispose of lithium batteries per Chapter B3 of this manual.

(5) Remove batteries from equipment before shipment or storage. Cover terminals of batteries with an insulating material to prevent short circuits.

(6) Store spare and used batteries in an adequately ventilated and cool fireproof area.

(7) Turn battery switch off when equipment is not in use or after the battery fails to operate the equipment.

D0505. ELECTRICAL FIRES

a. For electrical fire fighting procedures, see Naval Ships' Technical Manual, Chapter 555.

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b. Main Storage Battery Fires

(1) A battery fire is nearly always preceded by an explosion. Great care is required fighting such a fire to avoid creating another explosion.

(2) The safest and most effective method for fighting a battery well fire is through oxygen starvation. Secure the well and stop all ventilation within, including agitation air, to deprive flames of oxygen.

**CAUTION**

**NEVER attempt to extinguish a battery fire by pouring water on the battery. The hydrogen and oxygen generated by electrolysis could produce a violent explosion.**

**c. Electrical Fire Prevention**

- (1) Keep electric motors and generators clean.
- (2) Ensure proper maintenance is performed on electrical equipment, i.e., motors, generators, bearings, and filters.
- (3) Report overheating or arcing of any electrical equipment.
- (4) Keep air filters clean.

**D0506. FIRST AID FOR ELECTRICAL SHOCK**

a. Fundamentally, electric current rather than voltage is the criterion of shock intensity. The passage of even a very small current through a vital part of the human body can cause death. The voltage necessary to produce the fatal current is dependent upon the resistance of the body, contact conditions, the path through the body, etc.

b. It is imperative to recognize that the resistance of the human body cannot be relied upon to prevent a fatal shock from 115 volts or even lower voltage; fatalities from as low as 30 volts have been recorded. Tests have shown that body resistance under unfavorable conditions may be as low as 300 ohms and possibly as low as 100 ohms from temple to temple if the skin is broken. Volt for volt, DC potentials are normally not as dangerous as AC as evidenced from the fact that reasonably safe "let-go currents" for 60 hertz alternating current is 9.0 milliamperes for men while the corresponding values for direct current are 62.0 milliamperes for men.

(1) Symptoms of Electrical Shock. In the event of severe electrical shock, the victim could become very pale or "bluish." His pulse is extremely weak or entirely absent, unconsciousness is complete, and burns are usually present. The victim's body may become rigid or stiff in a few minutes. This condition can be caused by muscular reaction to shock, and it shall not, necessarily, be considered as rigor mortis. Therefore, artificial respiration shall be administered immediately, regardless of body stiffness, as recovery

from such a state has been reported. Consequently, the appearance of rigor mortis shall not be accepted as a positive sign of death.

(2) Rescue of Victims. The rescue of electrical shock victims is dependent upon prompt administration of first aid. All electrically trained personnel shall be trained annually in cardiopulmonary resuscitation (CPR) procedures by an instructor certified by an authorized agency, such as the American Red Cross or the American Heart Association.

#### CAUTION

**DO NOT ATTEMPT TO ADMINISTER FIRST AID OR COME IN PHYSICAL CONTACT WITH AN ELECTRICAL SHOCK VICTIM BEFORE THE POWER IS SHUT OFF, OR, IF THE POWER CANNOT BE SHUT OFF IMMEDIATELY, BEFORE THE VICTIM HAS BEEN REMOVED FROM THE LIVE CONDUCTOR.**

(3) When attempting to administer first aid to an electrical shock victim, proceed as follows:

(a) Shut off the power.

(b) If the power cannot be deactivated, per step (a), remove the victim immediately, observing the following precautions.

1. Protect yourself with dry insulating material.

2. Use a dry board, belt, dry clothing, or other available non-conductive material to free the victim (by pulling, pushing, or rolling) from the power-carrying object. DO NOT TOUCH the victim.

(c) Immediately after removal of the victim from the power-carrying object, administer CPR.

(d) When providing initial first aid measures, any possible spinal injuries or fractures should be taken into account.

#### **D0507. ELECTRONIC PRECAUTIONS**

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##### **a. Definitions**

(1) Repair - Removal or replacement, by any method, of any component, subassembly, module, circuit card, or conductor to bring malfunctioning equipment back to an operational status.

(2) Corrective maintenance - Alignment, adjustment, tuning, or trouble shooting of malfunctioning equipment per published maintenance or technical manual procedure.

(3) Preventative maintenance - Alignment, adjustment, tuning, or testing of operational equipment to ensure performance within published maintenance card or technical manual procedures.

b. Repair of electronic equipment is normally accomplished with the circuit deenergized. Every effort should be made to avoid making repairs to energized equipment. DO NOT repair energized electronic equipment unless you are using approved procedures from technical manuals or other documentation, or an emergency condition exists and the commanding officer has granted permission to perform such repair. In such an emergency, trained personnel shall accomplish the repair of energized circuits and an experienced technician or officer shall supervise. Electronic repair personnel should observe the safety precautions in section 3-4 of the Electronics Installation and Maintenance Book (EIMB), NAVSEA SE 000-00-EIM-100, General Handbook.

c. Corrective maintenance on energized electronic equipment is authorized when done according to published maintenance or technical manual procedures. Freelance corrective maintenance (i.e., maintenance without a procedure) on energized electronic equipment shall be performed ONLY with the specific permission of the commanding officer.

d. Preventive maintenance on energized electronic equipment is authorized when it is according to a published maintenance requirement card or technical manual procedures.

e. Perform preventive or corrective maintenance on energized electronic equipment only when duly authorized and trained on that type of equipment.

f. Whenever work on energized electronic equipment exposes the technician to 30 volts or greater adhere to the following precautions:

(1) Study the applicable schematic and wiring diagrams before servicing.

(2) Research into or enter energized electronic equipment enclosure for the purpose of servicing or adjusting only when prescribed by applicable technical manuals, maintenance requirement card, or other approved documentation.

(3) Obtain the commanding officer's permission whenever work on energized electronic equipment deviated from published corrective or preventive maintenance procedures.

(4) Station a safety observer capable of securing power and rendering adequate aid in the event of an emergency.

(5) Provide warning signs and suitable guards to prevent personnel from coming in accidental contact with dangerous voltage.

(6) Obey all warning signs and heed all equipment warning labels.

(7) Insulate the work from ground with approved electrical grade rubber matting. Installation requirements for electrical grade matting are contained in Chapter 634 or NSTM.

(8) Remove or snugly secure any loose clothing. Remove all jewelry.

(9) Insulate all metal tools.

(10) Use only one hand, if practical, in accomplishing the work.

(11) Wear electrical grade rubber gloves on both hands, if possible. If the nature of the work is too cumbersome to wear gloves on both hands, then a glove shall be worn on the non-working hand.

g. Reaching into deenergized equipment also required special care and precaution.

(1) Study the applicable schematic and wiring diagrams before servicing.

(2) Ensure you are familiar with all circuits that must be deenergized and all voltage storing and high voltage components.

(3) Discharge all voltage storing components with an approved shorting probe.

(4) Do not touch a conductor or electronic component unless you have proven it to be deenergized by using a known good voltage tester.

h. Removal of a unit or part from the normal location within an assembly and the energizing of the unit or part, while it is outside the normal enclosure, removes the protective features such as interlocks, grounded, and enclosures. These safety features may then no longer function as designed. Ground the chassis and frame of all units removed for servicing and ground all circuits normally grounded in operation whenever power is applied to the unit.

i. Do not energize any equipment that is tagged out. Properly clear the tag out first.

j. Never defeat an interlock or built-in safety device. Modify such safeguard circuits only as authorized by the cognizant system command.

k. Refer to Chapter 300 of NSTM and Chapter 3 of EIMB General Handbook for additional precautions regarding electric systems.

#### **D0508. TAG-OUT PRECAUTIONS**

Submarine Force tag-out procedures (COMSUBLANT/COMSUBPAC Joint Instruction 5101.2 (Series)) shall be enforced at all times. Enforcement is necessary during normal operations as well as during repair, construction, testing, or maintenance.

CHAPTER D6  
SHIPBOARD FUELS

D0601. DISCUSSION

Fuels are used aboard submarines to power emergency auxiliary equipment. The biggest hazard with shipboard fuels is explosion and fire. Other hazards include asphyxiation, body burns, dermatitis, eye and respiratory difficulties, and environmental hazards. Due to the incredible impact a shipboard explosion and fire would have, the possibility that a catastrophe could occur should constantly be in the minds of all personnel, especially those involved in fuel storage and transfer operations.

D0602. PRECAUTIONS

- a. Never smoke in fuel storage or transfer areas during maintenance, fueling, or venting operations.
- b. Prohibit any open flames, hot work, or the use of non-explosion proof fixtures or equipment near opened fuel storage or transfer areas. Fluorescent fixtures are permitted in areas in which fuel is handled.
- c. Ensure forced ventilation is in operation during fueling or venting operations.
- d. Always ventilate fuel tanks and obtain gas-free engineer's certification before entering. Ship's medical department representative may certify for entry of ship's force only.
- e. Never enter a fuel tank to aid an unconscious crew member without proper respiratory protection and a back-up person standing by.
- f. Detect leaks and make immediate repairs in all fuel systems. Clean up pools of leaked or spilled fuel immediately.
- g. Inspect tanks, piping, fuel hoses, pumps, and communication equipment before transferring fuel. Ensure a drip pan is under all transfer hose connections and that gaskets are in place in hose joints and couplings.
- h. Store oily wastes and rags in an approved container.
- i. Do not discharge fuel or oily wastes over the side.
- j. Ensure that flash screens (flame arresters) on tank vents are in place and in good material condition.

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k. Check air relief valves or pressure-vacuum relief valves to ensure that they are operating properly in accordance with the Planned Maintenance System (PMS).

l. Do not move fuel until all involved have signaled readiness. Maintain a hose and overboard discharge watch during transfer operations.

m. Frequently monitor fuel levels in tanks. Constantly monitor fuel level when fueling.

n. Avoid physical contact with fuel(s).

o. Do not inhale fuel vapors. Consult with the respiratory protection officer (RPO) to identify an appropriate respirator.

p. Always ground hoses before transferring fuel. Do not break that ground until hoses are disconnected.

q. While pierside, stop all transfer operations during electrical storms or thunderstorms.

R) r. Install flange shields over pipe joints in accordance with Naval Ships Technical Manual, Chapter 505, Section 7.7. The purpose is to prevent flammable liquids from spraying over a greater area or contacting hot surfaces in the event a leak occurs.

CHAPTER D7

WELDING, CUTTING, AND BRAZING

D0701. DISCUSSION

a. The convenience of metal arc and gas welding and cutting lies largely in the fact that the equipment can be taken to the job. This convenience leads to the performance of construction or repair jobs in spaces that have not been designed for such concentrated heat, or mixtures of toxic or explosive gases. The failure to take proper precautions, during welding or cutting operations in such spaces, presents a serious fire, explosion, electric shock, and health hazard.

b. Health hazards common to welding, cutting, and brazing are numerous. In addition to electric shock, burns to the eyes and skin can be caused by sparks, molten metal, and ultraviolet and infrared radiation. Fumes and gases generated by welding can produce ozone and oxides of nitrogen which are poisonous. Lead, zinc, chrome, and cadmium in alloys produce toxic fumes. Paints and coatings may produce toxic gases and fumes when heated by the flames of the welding torch. Additionally, any metal fume is capable of producing metal fume fever. Local exhaust ventilation is a must to remove excessive concentrations of air contaminants. Welding in closed, unventilated spaces can result in respiratory irritation or poisoning of personnel.

c. Hot work includes:

- (1) Flame heating, welding, torch cutting, brazing, carbon arc gouging
- (2) Any operation producing temperatures of 400°F or higher

NOTE:

(R)

Operations not producing **hot** sparks and flames such as spark-producing or arc producing tools or equipment, static discharge, friction, open flames or embers, impact, and non-explosion-proof equipment such as lights, fixtures, or motors are not considered hot work unless occurring in the presence of flammable liquids or in a flammable atmosphere.

d. Where only class alpha materials (ordinary combustibles) (e.g., wood, cloth, paper, rubber, and many plastics) are exposed, hot work is divided into two classes. These are:

(A)

(1) **Class I.** These processes produce either high energy sparks or slag that can be thrown or dropped at the work site or produce heat that can be transferred through the deck, overhead, bulkhead, or structure to a location not visible to the hot work operator. This class includes:

- (a) Flame cutting

- (b) Welding
- (c) Plasma cutting
- (d) Arcing and gouging
- (e) Electric arc welding
- (f) Thermal spraying
- (g) Other hot spark or flame producing process not included in class II.

(2) **Class II.** These processes produce flames or minimal energy sparks or slag which are generally localized to the immediate work area. This class includes:

- (a) Stud welding with an electric stud gun
- (b) Gas-tungsten-arc (GTA) welding
- (c) Torch brazing
- (d) Ferrous metal grinding with abrasive disks.

**D0702. PRECAUTIONS**

**a. Clothing**

- (1) Use goggles, faceshield, fume respirators, flameproof gloves, jackets, leggings and boots, as appropriate.
- (2) Remove lighters from pockets during hot work.
- (3) Do not wear synthetic-fiber clothing.
- (4) Do not roll up sleeves, cuffs, or have open pockets.
- (5) Always wear a welder's jacket or sleeves and apron while welding. Helmets and faceshields shall be fitted with the proper filter and cover lenses.
- (6) Always wear gloves when removing or replacing electrodes, or handling energized holders, tables, or equipment. The gloves shall be dry and in good condition.
- (7) Cartridge respirators, when properly selected (see Chapter B6), will protect against the metal fumes generated during welding. They do not provide oxygen, which may be necessary when working in a confined space. If sufficient ventilation is not available, they will not protect against hazardous gases which may be generated during welding; particularly MIG and TIG welding. Where either condition exists, use a supplied-air respirators.

b. Space Precautions

(1) The following precautions shall be observed during the performance of hot work: (R)

(a) Do not perform hot work when flammable liquids or flammable atmospheres are present without specific instructions of the Gas Free Engineer.

(b) Inspect the other side of the bulkhead, deck, overhead, or other structure to ensure that hot work will not damage materials or equipment that may be on the other side of the hot work operation.

(c) Remove explosive materials and flammable liquids or vapors and take suitable precautions against the reaccumulation of such materials. For welding in spaces in which explosive materials are located (torpedo rooms, missile compartments, etc) refer to NAVSEA OP-4, *Ammunition Afloat*.

(d) Where practicable, relocate all combustibles at least 35 feet from the work site. Where relocation is impracticable, protect combustibles with metal guards or curtains constructed of MIL-C-24576 material. Tighten edges of covers at the deck to prevent sparks from going underneath the cover. This precaution is also important at overlaps where several covers are used to protect a large pile of combustibles.

(e) Protect intricate and vulnerable machinery and equipment from falling sparks or other potential sources of fire with metal guards or curtains constructed of MIL-C-24576 material. Secure protection in-place before commencing hot work.

(f) For hot work processes that generate slag, weld splatter, or sparks, cover openings in decks, bulkheads, or overheads within 35 feet which can be a path to prevent ignition sources from passing into adjacent compartments, spaces, or decks below. A complete containment system as described in chapter 074 section 10 of the Naval Ships Technical Manual (NSTM) meets this requirement. If openings cannot be covered, post a fire watch on the far side.

(g) Blank-off ducts that might carry sparks to distant combustibles or otherwise suitably protect.

(h) When hot work is done near decks, bulkheads, partitions, or overheads of combustible construction, take precautions to prevent ignition.

(i) Do not undertake hot work on pipes or other metal in contact with insulation or combustible decks, bulkheads, partitions, or overheads if the work is close enough to cause ignition by heat conduction.

(j) Do not start hot work in areas other than those specifically designated for hot work without approval of the commanding officer or his designated representative. Abrasive disk grinding with a small wheel (typically 3-inch diameter or less) does not require notification or approval.

(2) Ensure that a gas-free engineer's survey has been completed before working in tanks, voids, or spaces, including adjacent spaces (especially if those tanks contained flammable liquids or vapors) if these spaces are identified as a confined space per Chapter B8 of this manual.

(3) Obtain the commanding officer's permission before starting hot work underway (duty officer, in port). Conduct hot work in or on fuel tanks, in spaces in which fuel tank vents terminate, or in other confined spaces known to contain flammable fuel, only with the commanding officer's approval.

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(4) Set fire watches as follows:

(a) In **confined or enclosed spaces, machinery rooms, bilges, and other locations proximate to flammable atmospheres (e.g., near fuel tank vents and sounding tubes)**, post fire watches at the worksite when hot work is undertaken. After completion of the hot work operation, fire watches shall remain on station for a minimum of 30 minutes, ensure that the area is cool to the touch, and ensure that no smoldering embers remain.

(b) For **class I hot work**, post fire watches when hot work is undertaken. The fire watches shall stand watch for 30 minutes after hot work is completed.

(c) For **class II hot work**, a commanding officer's representative (normally the duty officer, engineering officer of the watch, or engineering duty officer) shall determine the need for a fire watch based on his assessment of the worksite prior to undertaking hot work. When posted, the fire watch(es) shall stand watch for 30 minutes after hot work is completed.

**NOTE:**

Abrasive disk grinding on a ferrous material with a large wheel (typically larger than 3 inches in diameter) typically throws large sparks long distances. A fire watch is recommended for large wheel grinding when class alpha materials (ordinary combustibles) are exposed. A commanding officer's representative shall determine the need for a fire watch.

(d) When a fire watch is not required for class II hot work, the hot worker shall have the appropriate fire extinguishing equipment available. The hot worker may leave the site after hot work is completed and after he/she has conducted a thorough survey of the area to check for smoldering fires. When grinding a ferrous material with a large abrasive disk wheel (larger than 3 inches in diameter), the hot worker shall stand watch for 30 minutes after the hot work ends.

(e) When any type of hot work is being performed on bulkheads, decks, or overheads where sparks or heat transfer may ignite combustibles on the opposite, accessible side, set a fire watch on the far side.

(f) The hot worker and the hot worker's supervisor are responsible for ensuring fire watches are in place prior to starting work.

(g) Train fire watches per NSTM, chapter 074, section 10.

(h) Equip fire watches with personal protective equipment (PPE) as required for the operation being conducted (e.g., appropriate eye protection (goggles, glasses, faceshield), helmet, respiratory protection, fire retardant clothing).

(i) When more than one fire watch is required, establish a communication means.

(5) Ensure fire extinguishing equipment is available in immediate area. (R)  
The types of fire extinguishing equipment to be used by fire watches is specified in NSTM chapter 074, section 10.

(6) When possible, use a shield painted with a non-reflecting coat of zinc oxide or flat black to separate the welder from other personnel.

(7) Contact the gas free engineer to ensure adequate ventilation is provided in the space prior to commencing hot work.

(8) Protect personnel in areas adjacent to welding sites from arc-produced ultraviolet radiation burns by using protective screens, goggles, or other approved means.

(9) When welding in a space which is entirely screened on all sides, arrange the screens so that they will clear the deck so as not to restrict ventilation carrying off the fumes and vapor from the operation.

(10) Never weld near a source of halocarbons, such as refrigerant. (R)  
Phosgene gas can be produced when halocarbons are exposed to high temperatures.

(11) Do not perform hot work during fueling or ammunition transfer operations.

(12) If welding/burning on areas treated with vinyl is anticipated, chip and scrape the area free of vinyl before starting hot work.

(13) Ship's force will not normally weld on the hull. If such welding is necessary, take proper precautions to ensure that special requirements are met. Accomplish radiography at the first opportunity.

c. **Practices**

(1) Only use non-shatterable type cylinders.

(2) Never use oxygen to operate pneumatic tools, blow out pipe lines, blow dust from clothing or work, create pressure, or for ventilation purposes.

(3) Do not carry oxygen, acetylene, or other fuel gas cylinders into confined spaces.

(4) Always return cylinders to the proper storage when work is completed and ensure cylinders are secured in place by metal retaining collars, if installed.

(5) Ground all electrical welding equipment before use.

(6) Stand on a dry surface or insulating material if surface is not completely dry to avoid electric shock.

(7) Do not work alone. Post designated personnel nearby for fire watch as well as rescue purposes. Immediate first aid care in case of an electrical shock may prevent serious consequences.

(8) Never permit the metal part of the electrode or the electrode holder to touch the bare skin or any damp clothing which the operator may be wearing. Do not loop the welding cable over your shoulder or other parts of your body.

(9) Do not put an energized electrode holder under the arm at any time. If an insulated surface or insulated holding peg is not available, remove the electrode and lay the insulated holder on the deck or other adjacent object.

(10) When stopping work for a significant time (lunch or over-night), remove electrode from electrode holder, deenergize the equipment and disconnect welding supply cable from the welding machine.

(11) Where conditions are crowded and welding must be performed close to other personnel, the welding operator shall take special care to ensure that the electrode and holder do not touch nearby occupants.

(12) When using portable machines, ensure that the primary supply cables are separately laid and do not become entangled with welding supply cables.

(13) Inspect work and electrode lead cables regularly for wear and damage. Replace cables with damaged insulation or exposed conductors. Use connecting devices specifically intended for the purpose when joining lengths of supply and electrode cables. Adequately insulate connecting devices for the proposed service conditions.

(14) Keep welding cables dry and free from grease and oil, wherever practical, to prevent premature breakdown of the insulation which could cause serious short circuits.

(15) Suitably support cables overhead when it is necessary to carry them some distance from the welding machine. If this cannot be done, and cables are laid on deck, protecte them in such a manner that they will not be damaged or interfere with safe passage of personnel. Take special care to see that welding supply cables are not close to power supply cables, lighting circuits, or any equipment that utilizes magnetic tapes or depends upon a magnetic principle for operation. Block hatches and doors to prevent damage to welding cables.

(16) To prevent short circuiting, protect welding equipment used in the open from weather conditions (e.g., rain, snow, sleet, spray).

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(17) Smoking cigarettes or other forms of tobacco shall not be permitted while welding or brazing.

d. Cylinder Safety Refer to Chapter D15 for compressed gas safety precautions.

**D0703. EXTRA PRECAUTIONS FOR WORK IN RESTRICTED ACCESS SPACES**

a. For the purpose of this section, a restricted space shall mean:

(1) A space with only one exit and,

(2) A space where equipment or structural barriers prevent easy exit or entrance.

b. Ensure proper ventilation is available to permit work in restricted access spaces. When sufficient ventilation cannot be obtained without blocking the means of access, personnel in the confined space shall be protected by air line respirators. Ensure space has been certified gas free, if the space is unmanned and ventilation is non-existent or the space is used to store hazardous material.

c. Leave gas cylinders and heavy welding or cutting equipment outside the restricted access space.

d. Station an attendant outside with instructions to observe the welding operator at all times, and in case of emergency, immediately shut off the gas or welding machine and render such help as the occasion warrants.

e. If entering a restricted access space through a manhole or other small opening, means shall be provided for quick personnel removal in case of an emergency. When safety belts and lifelines are used for this purpose, they shall be so attached to the body that the body cannot be jammed in a small exit opening.

f. If the access fitting to a restricted access space is remotely controlled, ensure measures are taken to secure and DANGER tag-out remote-control equipment to avoid accidental closing of doors.

g. If work in a restricted access space is suspended for any substantial period of time, electrodes shall be removed from the holders of arc welding equipment. One of the three following precautions must be taken:

(1) Remove all arc welding equipment from the restricted access spaces.

(2) Disconnect all such equipment from the source of power. This shall always be done if the equipment is to be left overnight.

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(3) Positively insulate all such equipment, including the electrode holder, so that no accidental contacts can be made even if the equipment is moved during this period.

h. In the case of gas welding equipment, always close the torch valves and the gas supply to the torch, when not actually in use, to eliminate the possibility of gas escaping through leaks or improperly closed valves. The gas supply to the torch must be able to be positively secured from outside the space. Torches shall remain in restricted-access spaces only for the period necessary to perform the required hot work. Overnight and at the change of shifts, the torch and hose shall be immediately removed from confined spaces when they are disconnected from the torch or other gas consuming device.

## CHAPTER D8

### MACHINERY

#### D0801. DISCUSSION

a. Machinery is located everywhere in the ship, from the more obvious examples of propulsion equipment in the engine room, to the less than obvious example of galley equipment. The purpose of this chapter is to define precautions for all types of machinery, including industrial equipment. Electrical safety precautions are covered in Chapter D5. Galley equipment is described in D13.

b. All machinery has moving parts. Whenever there are moving parts, there is the possibility of personnel injury. While personnel injury is one aspect of machinery injury, the fact that a person has interrupted the machinery process can lead to even more disastrous accidents. (R)

c. Except in emergencies, and then only when no qualified operator is present, no person shall operate, repair, adjust, or otherwise tamper with any machinery unless assigned by a competent authority, (for example, OOD, CDO, or EDO), to perform a specific function on such machinery. No person shall be assigned to operate or adjust machinery unless he has demonstrated a practical knowledge of its operations and repair and all applicable safety precautions, and then, only when qualified by the department head having cognizance over such machinery. Unqualified personnel will operate machinery only under the supervision of qualified personnel. (R)

#### D0802. GENERAL PRECAUTIONS

a. Never place any part of the body into moving machinery.

b. Never attempt to ride machinery which is not designed for transport.

c. Do not wear jewelry, neckties, or loose fitting clothing while operating equipment.

d. Wear proper protective clothing and equipment suited to the operation being performed (i.e., hearing protection, eye, hand and foot protection, dust and paint respirators).

e. Do not wear polyester or other synthetic clothing while standing watch or performing maintenance in main propulsion spaces.

f. Engineering personnel shall wear long-sleeved shirts with sleeves rolled down when on watch or when performing maintenance in machinery spaces where steam is circulating in piping systems or the diesel engine is in

operation. Suitable leather or other heavy type gloves shall be worn when working on steam valves or other hot units.

g. Observe manufacturer's safety precautions and warning labels when handling flammable or toxic liquids; in particular, ensure that ventilation is adequate. Avoid breathing toxic vapors; wear proper personnel protective equipment such as goggles and respirators.

h. Use only hand tools and work lights that are in good material condition. Electrical tools and lights shall be used only if inspected and approved. Special non-sparking and explosion-proof electrical equipment may be required in the presence of flammable solvents and fuels.

i. Ensure that equipment is deenergized and/or depressurized and properly DANGER-tagged before attempting to perform repairs or preventative maintenance.

j. When working in the vicinity of electrical equipment or electrical cables, be alert to the presence of dangerous voltages and avoid striking such equipment with tools of any kind. Should such damage inadvertently occur, report it immediately to the ship's electrical officer.

k. Do not use compressed air to clean personnel or clothing or to perform general space cleanup in lieu of vacuuming or sweeping. Compressed air may be used to clean machinery parts that have been properly disassembled provided that the supply air pressure does not exceed 30 pounds per square inch (psi) and that a proper safety shield tip is used. Wear safety goggles, hearing protection, and proper respiratory protection when using compressed air for cleaning machinery parts.

l. Hazardous materials (HM) are frequently used in the operation and maintenance of machinery. Refer to Chapter D15 for safety precautions associated with HM.

m. Supervisors shall ensure that personnel who incur any type of injury or who are exposed to any occupational hazard receive prompt medical attention.

n. Promptly reinstall shaft guards, coupling guards, deck plates, handrails, flange shields, and other protective devices removed as interference immediately after completion of maintenance on machinery, piping, valves, or other system components.

o. Beware of asbestos. Ensure proper handling/disposal requirements are followed (see Chapter B1). Asbestos fireproofing material is still common aboard some ships and asbestos can be found in sheet gaskets, spiral-wound (flexitallic) gaskets, pipe hangers, clutch plates, brake pads, and some lagging.

**D0803. MAINTENANCE**

Ensure that all installed safety devices, alarms, and sensors are inspected and/or tested following scheduled Preventive Maintenance System (PMS) and other Type Commander requirements.

- a. Assign the repair of defective safety devices a high priority.
- b. Oil leaks shall be corrected at their source. Spills of any kind shall be wiped up immediately and the wiping rags disposed of immediately or stored in fire-safe containers.
- c. Avoid trip hazards by maintaining proper stowage.
- d. Do not allow fire hazards to accumulate.
- e. Ensure that all firefighting equipment is kept in a maximum state of readiness at all times.
- f. Ensure repair lockers are properly outfitted and restored after each use.
- g. Continuously monitor fire and flooding alarm panels. No alarm or flag shall be allowed to go uninvestigated. Alarm panels known to give false or spurious indications shall either be labeled and repaired or replaced as soon as possible.
- h. Piping systems which have been opened for maintenance (after having been properly isolated and tagged-out of service) shall not be left open overnight. Install appropriate metal blank flanges if a section of piping has to remain open overnight or for any extended period of time. Add such temporary openings to the list of items to be checked by the below decks, shutdown roving watch, or space watch for the duration of the maintenance period.
- i. Open all tank or piping drains and/or vents before loosening manhole or handhold plates or flanges. Stand clear of such fittings when initially opening them after service.

**D0804. INDUSTRIAL EQUIPMENT**

**a. General Industrial Equipment Operation and Repair Safety**

(1) Read manufacturer's instruction books for essential details of readying machines and equipment for operation, cleaning, lubricating, and general care and maintenance. These instruction books, supplemented by technical handbooks, provide comprehensive instructions on all phases of shop practice.

(2) Inspect before operating industrial equipment (fixed or portable) to ensure that the equipment is in good working condition and that all installed or attached safety features (such as guards, limit switches, interlocks, and speed limiting controls) are in place and in good working order.

(3) Unplug or disconnect from power source and affix a red tag (DANGER - DO NOT OPERATE) on all fixed or portable industrial equipment requiring repairs.

(4) Shut off the power when changing industrial equipment parts such as face plates or chucks on lathes or drill bits in electric drills.

(5) Replace machine guards and safety devices after repairing, oiling or greasing, or after inspections or PMS have been completed before the machine is started or operated.

(6) Remove all industrial tools or test equipment used in making repairs, adjustments to machinery, or other shipboard equipment/systems so that all working parts of the machinery, equipment, or system will be free to operate without damage.

(7) Take care that no one is in a position to be injured when the machinery/equipment/system is again set in operation.

(8) Be sure all personnel are clear before starting any industrial tools or equipment.

(9) Make sure there is plenty of light to work by before operating a machine.

(10) See that tools and work are properly clamped before starting a machine.

(11) Only place/mount a saw, cutter head, grinding wheel, or tool collar on a machine arbor when the tool is the proper size to fit the arbor.

(12) Ensure each powered machine has a means of cutting off power which can be safely reached and operated from the operator's normal position, without reaching through the point of operation or other hazardous areas.

(13) On machines where injury to personnel might result if motors were to restart after power failures, check that provisions have been made to prevent machines from automatically restarting upon restoration of power.

(14) Make sure that operating controls are protected by recessing, guarding, location, or other effective means against unexpected or accidental activation of the machine.

(15) The point of operation is the area of a machine where the work is actually performed upon the material being processed. Check that the point of operation is guarded so that personnel cannot be injured by contact with the machine or by flying objects propelled from the machine. Methods of point-of-operation guarding include barriers, shields, interlocks, automatic feed and removal, and two-hand activation devices. The best guarding device is usually one designed and attached by the manufacturer as an integral part of the machine. This selection and design of guards other than those provided by the manufacturer must be adequate to protect personnel and not present a hazard in themselves.

(16) Power transmission devices include belts, chains, pulleys, shafting, fly wheels, gears, sprockets, and any other moving parts of a machine other than the point of operation. Ensure that power-transmission devices are enclosed within the machine or otherwise guarded or so located that it is not possible for personnel to contact the moving parts.

(17) Ensure non-skid strips are installed on the deck (at the point of operation) in front of permanently mounted machine tools. (A

b. Housekeeping

(1) Keep areas around machines clear of obstructions and in a non-slippery condition. Clean up all spilled oil or grease immediately.

(2) Keep machines clean.

(3) Do not clean chips from the surface of machines with compressed air or with hands; use a brush or hook and wear leather gloves.

(4) Do not use compressed air to clean clothing or to blow dust off the body or to assist in the cleanup of dust, debris, or other particulate matter.

(5) Do not place hand tools on lathes or other machines. Keep them in their assigned location.

(6) Turn off all power to the equipment before removing chips and other debris.

(7) Ensure that all portable tools (electrical or pneumatic) have been tested prior to initial use and periodically, as prescribed by PMS or other data.

(8) Ensure that all machine guards and other safety devices are in place prior to equipment operation.

c. Portable Power Tools

- R) (1) Ensure all portable electric power tools have a current safety inspection prior to use.
- (2) Ensure that deck grinders and pneumatic needle guns without positive accessory holding are equipped with an operable, manufacturer-installed "deadman" switch.
- (3) Keep portable power tools clean, lubricated, and in good repair.
- (4) Keep all electrical cords clear of moving parts when using portable electrical equipment around machine tools.
- A) (5) Wear and use necessary personal protective equipment.

d. Operating Precautions - General

- (1) Remove chuck keys, wrenches, or other devices used to attach accessories to industrial machines before operating.
- (2) Do not attempt to adjust a tool or feel the edge to be cut while the equipment or tool is in motion.
- (3) Never attempt to stop or grab by hand or apply a wrench or tool to moving work or to moving industrial-equipment parts.
- (4) Never lean against a machine that is running.
- (5) Never leave moving machinery unattended.
- (6) Do not distract the attention of a machine operator.
- (7) Remove cutting tools from machines when not in use.
- (8) Avoid excessive cutting speeds, feeds, and depth of cut. Keep hands clear of moving parts. Use a separate block to feed stock into cutting blades.

e. Securing for Sea. When securing for sea, take all precautions to ensure that components of industrial equipment or tools, including accessories, will not sway or shift with the motion of the ship. These precautions should include, but are not limited to, the following:

- (1) Lower the arm of top-heavy equipment, such as a radial drill press, to rest on the table or base of the machine and then clamp and block securely.

(2) Secure chain falls and other suspended equipment, such as counter-weights on drill presses.

(3) Secure tailstocks of lathes.

(4) Protect and secure tools stowed in cabinets or drawers. Secure drawers and cabinet doors.

(5) Inspect foundation bolts of heavy equipment annually in accordance with PMS to ensure tightness.

f. Posted Safety Precautions

(1) Post operating instructions and safety precautions tailored to the specific equipment at each piece of industrial plant equipment. Install warning plates, located to ensure visibility, wherever necessary to minimize possible injury. Also, instructions to never allow machines to run unattended and not to distract the operator while the machine is in operation are appropriate.

(2) Equipment hazard zones should be clearly established and marked per ship's plans and specifications or General Specifications for Ships, section 602j.

g. Safety Precautions for Specific Types of Equipment

(1) Pneumatic Tools - General

(a) Wear and use necessary personnel protective devices.

(b) Do not connect or drive pneumatic tools by air pressure in excess of that for which the tools are designed.

(c) Only authorized and trained personnel shall operate pneumatic tools.

(d) Lay pneumatic tools down in such a manner that no harm can be done if the switch is accidentally tripped. Do not leave idle tools in a standing position.

(e) Keep pneumatic tools in good operating condition and thoroughly inspect them at regular intervals with particular attention given to on-off control-valve trigger guard (if installed) and hose connections.

(f) Pneumatic tools and air lines may be fitted with quick-disconnect fittings which incorporate automatic excess flow shut-off valves, which shuts off the air at the air lines before changing grinding wheels, needles, chisels, or other cutting or drilling bits.

(g) Only use air hose which is suitable to withstand the pressure required for the tool. Remove leaking or defective hoses from service.

(h) Do not lay hoses over ladders, steps, scaffolds, or walkways in such a manner as to create a trip hazard. Where a hose is run through doorways, protect the hose against damage by the door edge. Preferably, elevate air hose over passageways or working surfaces in a manner to permit clear passage and prevent damage to the hose.

(i) Connect a tool retainer on each piece of equipment which, without such a retainer, may eject the tool.

(j) Ensure that all portable pneumatic grinders are equipped with a safety lock-off device. The lock-off device must automatically and positively lock the throttle in the off position when the throttle is released.

(k) Ensure that air hoses are equipped with "quick disconnect" fittings at all hatches, doors, or scuttles.

(2) Buffers, Grinders, and Cut-Off Wheels - General

(a) Check the spindle speed of the machine before mounting of the wheel to be certain that it does not exceed the maximum operating speed marked on the wheel.

(b) Gently tap wheels with a light non-metallic implement, such as the handle of a screwdriver for light wheels, or a wooden mallet for heavier wheels, immediately before mounting. If they sound cracked (dead) they shall not be used. This is known as the "ring test." It should also be noted that organic-bonded wheels do not emit the same clear metallic ring as do vitrified and silicate wheels.

(c) Wheels must be dry and free from sawdust when applying the "ring test," otherwise the sound will be deadened.

(d) Dress or replace wheels that are chipped, rounded, or worn out of round prior to using the grinder.

(e) Replace fabric buffer wheels that are frayed or worn out of round.

(f) Replace wire buffer wheels that are badly worn or loose at the hub.

(g) Permanently-mounted buffers and grinders shall have a shatterproof safety shield in place between the operator's eyes and the work at all times while buffing and grinding. Wear a face shield and safety goggles or safety glasses when operating either portable or permanently mounted buffers or grinders.

(h) Clean the flange surface of grinding and buffing wheels, normally placed between washers and the spindle hole, before mounting the wheel so that clamping pressure will be evenly distributed.

(i) Ensure that the hole in the buffer or grinding wheel is of the proper size for spindle (neither too small nor too large).

(j) Use compression washers as large as the flanges in diameter for buffer and grinding wheels.

(k) Tighten spindle nuts just enough to keep the buffer or grinding wheel from moving out of position between the washers.

(l) Mount tool or work rests on firm supports and space not more than 1/8 inch from the surface of grinding wheel.

(m) Ensure that the hood around grinding wheels is constructed so its periphery can be adjusted to the constantly decreasing diameter of the wheel by means of an adjustable tongue or equivalent. Maintain the distance between the wheel periphery and the tongue or end of the periphery band at approximately 1/4 inch.

(n) Ensure that the upper point of opening in the grinding wheel hood facing the operator is not less than 25 degrees and not more than 65 degrees from a vertical line drawn through the spindle center.

(o) Ensure that the maximum exposure of a grinding or cut-off wheel periphery or circumference for hoods on a swing frame machine does not exceed 180 degrees and the top half of the wheel is protected at all times.

(p) Ensure that the maximum exposure of the wheel periphery or circumference on bench or floor stands does not exceed 90 degrees.

(q) Protect cup-type wheels used for external grinding by either a movable cup guard or a band type guard. Provide all other portable abrasive wheels used for external grinding with safety guards (protection hoods), except as follows:

1. When the work location makes it impractical, use a wheel equipped with safety flanges.

2. When using wheels 2 inches or less in diameter, securely mount the wheel on the end of a steel mandrel.

(r) When safety flanges are required, use them only with wheels designed to fit the flanges. Use only safety flanges of a type and design and properly assembled as to ensure that the pieces of the wheel will be retained in case of accidental breakage.

(s) Ensure portable abrasive wheels used for internal grinding are provided with safety flanges (protection flanges), except as follows:

1. When wheels are 2 inches or less in diameter, securely mount on the end of a steel mandrel.

2. If the wheel is entirely within the work area being ground.

(t) Ensure that all deck or bench mounted abrasive wheels have a work rest. Keep the work rest adjusted to within 1/8 inch of the wheel periphery to prevent the work from being jammed between the rest and the wheel.

(3) Operating Grinding, Buffing, and Cut-Off Wheels

(a) Stand to one side of the wheel when first applying power.

(b) Take care that the hands are not drawn into contact with buffing, grinding, and cut-off wheels.

(c) Never operate stationary grinding wheels unless protective eye guards and hooks are in their place and the tongue or the tool rest is correctly adjusted.

(d) Never operate portable pneumatic or electric grinding machines using wheels and wire brushes without a hood.

(e) Before the power is turned on, check to ascertain that the wheel runs true, is not out of balance, and does not strike or rub against housing, hood, safety shield, or tool rest. Dress wheels as necessary.

(f) Never use a grinding wheel on nonferrous materials.

R) D0805. TRASH COMPACTOR/TRASH DISPOSAL UNIT

The following is a list of precautions applicable to the submarine trash compactor:

R) a. When working with disposable cans, wear cut resistant gloves. Be careful of any sharp edges.

b. Keep unit clean and sanitary.

c. Do not load wet garbage or liquids into the trash compactor. Drain excess liquids from containers that are to be compacted.

d. Do not put rigid materials, such as thick metal or wood, into the compactor.

e. Ensure that disposable cans are properly formed to prevent hang-up in or damage to the trash disposal unit muzzle ball valve mechanism.

f. Do not attempt to service the compactor while it is in operation. Ensure that the hydraulic supply isolation valve is shut and DANGER tagged in accordance with the Submarine Force tag-out procedures.

g. Do not modify interlocks to exercise the trash compactor without closing the cover.

h. Wear safety glasses, cut-resistant gloves and a rubber apron when operating the trash compactor. (A

i. Ensure legible operating instructions are posted for the trash compactor and trash disposal unit. (A

j. For SSBN 726 class trash compactors:

(1) Before unlatching the retainer doors, ensure that the safety hood (cover) is raised.

(2) Do not place hands under the ram unless the safety hood (cover) is raised and the hydraulic supply isolation valve is shut.

(3) Before opening the hydraulic supply isolation valve, ensure that the ram control valve is latched in the centered position and the retainer doors are shut and latched.

(4) Do not operate the ram with the doors open.

(5) Ensure that all four toggle pins on the retainer doors are securely latched shut before operating unit. Failure to do this may result in the container bursting under compactor pressure unit.

k. For other submarine trash compactors:

(1) Pin lock the hydraulic control valve in the NEUTRAL position to prevent inadvertent operation while loading the compactor.

(2) Prior to compacting, ensure that the disposable container is in full contact with the retainer to prevent container distortion during compacting.

(3) Prior to compacting, ensure the retainer is securely latched in place so the ram will be unobstructed when it is lowered.

(4) Material must never be inserted into the compactor while the retainer is positioned vertically under the ram and the control valve is in a position other than locked in the NEUTRAL position.

CHAPTER D9  
SANITATION SYSTEMS

D0901. DISCUSSION

Submarine sanitation systems are designed and operated to prevent the overboard discharge of untreated sewage into navigable waters of the United States or other countries. Sanitation systems hold raw sewage until it can be discharged overboard or to a pier connection.

D0902. GAS FREE ENGINEERING FOR SANITATION SYSTEMS

a. Do not open or enter a sanitary tank or remove a component which will leave an opening to the tank unless inspected and certified by a gas free engineer, industrial hygienist (certified GFE), or National Fire Protection Association (NFPA) marine chemist, since toxic and explosive gases may exist in the tank.

b. Observe a no smoking regulation. Do not allow open flame, ordinary electric lights, flashlights, regular tools, or sparking electrical apparatus in or near an open tank.

c. Recertify (gas free) open sanitary tanks at least every four hours. It must be recognized that even though a tank may be certified gas free, toxic gases can remain in the sludge blanket and could be released when the blanket is disturbed.

d. Before opening a tank in any manner, or removing any valves or components below the highest level of the tank overflow, wear proper respiratory protective equipment (see Chapter B6 for respiratory protection requirements).

e. Force-ventilate the tank continuously after opening. Ventilation should be sufficient to provide a change of air in the tank every three minutes. Avoid contamination of the air compressor or ventilation intakes.

f. Work can continue outside the tank without respirators once forced ventilation of the tank has commenced.

g. Do not weld or perform hot work inside or outside the tank without a gas free engineer determining that the tank is safe for hot work. After welding is complete, inspect the coating for heat damage and repair as necessary.

h. See NSTM, Chapter 593, Pollution Control, section 4, for additional information and precautions.

**D0903. SUBMARINE SANITATION SYSTEMS**

a. Control of Toxic Gas Hazards. In order to minimize the potential hazards resulting from the release of toxic gases from the sanitation system, the following precautions shall be observed:

(1) Venting pressure from the sanitary tank should be done through the installed restriction lines to improve filtering by installed charcoal filter by reducing gas velocity through the charcoal. Use of the restrictor lines also minimizes the chance of wetting the charcoal with entrained moisture.

R) (2) Always assume that the sanitary tank contains sewage and toxic gases, and has an oxygen-deficient atmosphere. Be especially attentive for hydrogen sulfide ( $H_2S$ ), a gas with a rotten egg smell at low concentrations. This odor is not reliable as a warning signal because  $H_2S$  deadens the sense of smell. As the  $H_2S$  concentration increases, the degree of danger increases.

(3) Never enter the tank or open the manhole access at any time unless at a suitable industrial facility, and only after certification by a gas free engineer, industrial hygienist (certified GFE) or NFPA marine chemist.

(4) To minimize hazards, always flush tanks and blow twice and ensure gas free if components are to be removed or disassembled outside the tank, or from the piping below the highest point of the sanitary tank overflow.

(5) Always recheck gas levels in the tank before reopening the tank or piping to replace repaired components if more than 2 hours have elapsed since the tank was last certified gas free (1 hour if the ambient temperature is above 90 degrees Fahrenheit).

(6) If levels of gases have climbed above acceptable limits, repeat flushing procedure.

(7) Wear proper respiratory protective equipment when replacing components.

(8) In any space where a sewage spill has occurred, do not conduct any work or maintenance other than work required to clean up the spill, until gas levels are below acceptable limits and all sewage wastes, including solids, have been removed from the space and the space washed down.

b. Safety Precautions for Sanitary Systems

After completion of sewage-transfer-hose blowdown or seawater-flushing, ensure transfer hose is depressurized. Close discharge valves prior to disconnecting sewage hose.

c. Safety Requirements for Sanitary Systems Maintenance

(1) Do not attempt sanitary system maintenance until the safety requirements and precautions have been thoroughly read and understood and only use the specific procedures for this maintenance outlined in the Ship's Information Book. If these procedures cannot be followed due to some equipment malfunction, maintenance shall be deferred until a suitable industrial facility/service becomes available.

(2) If maintenance not requiring tank entry calls for equipment to be removed which will leave an opening in the tank, or calls for the removal or disassembly of any valve or piping component or anywhere below the highest point of the sanitary tank overflow piping, the following safety precautions shall be observed:

(a) Post a safety watch with a spare respirator at the access.

(b) Ensure that the installed ventilation system is operating properly and that the compartment access is open. The ship's gas free engineer shall determine if any additional temporary ventilation is required.

(c) Flush the tank and piping.

(d) Immediately seal openings using either blank flanges or a suitable sealing device.

(e) Have a gas free engineer recheck the tank atmosphere using a proper respirator before replacing failed components if more than 2 hours have elapsed since the tank was last certified gas free (1 hour if ambient temperature is above 90 degrees Fahrenheit). If levels have climbed above acceptable limits, repeat flushing procedure until acceptable levels are obtained. Equipment or components can then be replaced using proper respirators.

(f) Wash down the area with hot potable water and stock detergent.

WARNING

NEVER assume a tank is empty or is not dangerous because the tank has not been in use.

D0904. SANITARY, HYGIENIC, AND SAFETY PROCEDURES

a. Hygienic Procedures. The following hygienic procedures are applicable to all submarine sanitation systems:

(1) If connecting or disconnecting sewage transfer hoses, do not subsequently handle potable water hoses without a thorough washup (hands, lower arms, and face in that order) with hot soap and water.

(2) Wear rubber gloves, rubber boots, faceshield and coveralls, while connecting or disconnecting sewage hoses.

(3) Do not smoke, eat, or drink prior to a thorough washup with hot water and soap after working on sanitation systems.

(4) Ensure that personnel exposed to sewage or who work on sanitation systems maintain basic immunization current as required by NAVMEDCOMINST 6230.1A and NAVMEDCOMINST 6230.3.

(5) Verify that health warning placards are posted in appropriate locations, identifying procedures to be followed in those areas.

**b. Maintenance Procedures**

(1) Wear protective rubber gloves, rubber boots, faceshields, and coveralls when performing maintenance which requires disassembly of sewage equipment or when contact with sewage is possible.

(2) Wash down the area and components with hot potable water and stock detergent and rinse with sea-water or fresh water upon completion of maintenance.

(3) When sanitation system maintenance is complete, place protective clothing contaminated with sewage in two plastic bags for transport to the laundry. Use dissolvable bags plus an outer fabric or plastic bag, where possible, to prevent contact with sewage contamination.

(4) Wash rubber boots and gloves in hot potable water and stock detergent, and rinse with an approved disinfectant solution.

(5) Launder sanitary-soiled fabric protective clothing separate from other laundry items in 160 degrees Fahrenheit water or water containing a disinfectant such as bleach.

(6) Never walk through living, eating, working, or any manned spaces while wearing protective clothing, boots, or gloves that were worn while working on sanitary systems.

(7) Thoroughly wash hands, lower arms and face, IN THAT ORDER, with hot water and soap, using the nearest washup facilities following maintenance.

**c. Leak or Spill Clean-up Procedures**

(1) In the event a space becomes contaminated with sewage as a result of leaks, spills, or sewage system backflow, evacuate the space immediately and notify the executive officer, damage control assistant, and the medical department representative.

(2) Secure the spill area from traffic.

(3) Test the area for explosive/combustible and toxic gases including hydrogen sulfide ( $H_2S$ ), carbon dioxide ( $CO_2$ ), and methane ( $CH_4$ ). If the area is free of gases, use of respirators is not required; however, maintain EABs readily available at the scene. (R)

(4) Remove spilled sewage and wash down with water and stock detergent.

(5) The MDR must certify the space as clean. If food service, berthing, or medical spaces are involved, the MDR shall ensure they are washed down with an approved disinfectant.

(6) The MDR shall ensure personnel involved in the cleanup operations have current immunizations.

d. Sewage Transfer Operations

(1) Wash with hot potable water and stock detergent, and rinse with sea water or potable water, all deck discharge connections, components, and immediate deck areas each time sewage transfer operations are terminated and the sewage hose is disconnected.

(2) Check the discharge connection periodically during sewage transfer operations to ensure that the connection is intact and that an unsanitary condition is not developing.

e. Contaminated Bilges

(1) Bilges contaminated with sewage wastes shall be pumped out, washed down, and pumped out again.

(2) If potable water tanks form the deck or any boundary of the bilge, daily monitor the water from those tanks for coliform contamination. Continue monitoring until it is assured that sewage contamination of the tanks has not occurred.

(3) If the potable water system is suspected of being contaminated, secure the appropriate tanks until the problem is corrected and the water is determined to be safe for consumption.

(4) Refer to OPNAVINST 5090.1A (NOTAL) prior to discharging overboard in restricted waters.

CHAPTER D10

HEAVY WEATHER

D1001. DISCUSSION

a. Heavy weather is any weather that results in high winds, extreme sea states, heavy rains, snow and/or hail. While a submarine is on the surface, heavy weather will generate excessive rolls, yaws, and pitching which makes working and living conditions on board a potential dangerous environment.

b. There are a multitude of hazards that may occur in heavy weather. Objects can slide and fall on personnel, causing injury. Personnel can fall into machinery or equipment. Personnel topside and on the bridge can be swept overboard. Heavy weather is as dangerous now as it was during the days of sail, and all personnel must be aware of potential hazards and safety requirements.

D1002. SAFETY PRECAUTIONS FOR INPORT AND/OR MOORED

a. Keep complete topside safety lifelines and stanchions rigged at all times while inport except when mooring another submarine alongside. Do not dismantle any lifeline on the ship without the Duty Officer's permission and ensure temporary lifelines are rigged prior to dismantling. Keep lifelines and stanchions in good repair. (R)

b. Keep complete floating lifelines rigged at all times while moored. Keep floating lifelines in good repair.

c. Keep an accommodation (Jacob's) ladder rigged from the ship's safety track or cleat to the waterline in the vicinity of the hatch used for ship access at all times while moored or anchored. Keep ladder in good repair. The accommodation (Jacob's) ladder must be attached so that it can be quickly removed and relocated to another location. (R)

d. Inspect all topside safety equipment daily. Ensure that gear adrift topside is removed at all times and report any unsafe conditions to the immediate supervisor.

e. Topside watchstanders inport will wear approved topside shoes.

f. Topside watchstanders will be secured to the ship and/or wear a Kapok life jacket after dark, in inclement weather, and at other times prescribed by the duty officer.

g. If worsening weather conditions make it prudent to shift the watch to the bridge, ensure that topside equipment is unrigged as feasible and secure topside for sea.

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h. Normally mooring lines are doubled. With worsening weather conditions, use triple lines and/or install wire rope lines. Forward and after wire rope night riders may also be used.

**D1003. OPEN OCEAN OPERATIONS**

a. Based on the consideration of personnel safety, sending personnel topside in open sea should be authorized only for emergency situations, Sea Air Rescue operations, and extreme tactical necessity.

b. Personnel going topside should be inspected by the chief of the watch to ensure they are wearing the proper gear and that it is donned properly. Personnel going topside should utilize the buddy system such that one man in the hatch will tend a safety line to each man going topside until he has fastened his safety harness to the safety track. Conversely, when proceeding below, each man will attach the line being tended from the hatch to his safety harness before disconnecting from the safety track.

c. Personnel may be required to go topside through the bridge access hatch vice topside access hatches due to severe weather. These personnel are required to be inspected to ensure the wearing of appropriate safety equipment prior to exiting the control room.

d. During normal surfaced underway steaming, all bridge personnel shall wear, as a minimum, a stowed Steinke hood or other approved personal flotation device. Personnel that are required to man the bridge during heavy weather should wear a safety harness attached to the bridge and wear a life jacket. For extreme high seas, rig the bridge for dive and shift the watch to control.

A) e. Use of a cranial helmet and a fibrous life jacket will minimize potential injuries when striking the hull or deck if washed overboard.

CHAPTER D11

ABANDONING SHIP

D1101. SAFETY PRECAUTIONS DURING ABANDONING SHIP

a. Wear a full set of clothing including shoes and a soft cap or head covering as protection from exposure.

b. Inherently buoyant type life jackets shall be securely fastened. Inflatable life jackets (Steinke hoods) shall not be inflated until the wearer is in the water. The life jacket shall be inflated as soon as wearer is in the water.

c. Do not dive, always jump feet first.

d. Always abandon ship as far away from the damage as possible.

e. Know direction of the wind and go to windward side of ship, if possible, to avoid flames, oil, and drift of ship.

f. When in water, concentrate on staying calm and avoiding panic. Obey the following rules:

(1) Conserve energy by moving as little as possible.

(2) Keep clear of oil slicks if possible. If possible, protect eyes and breathing passages by keeping head high or swimming underwater. If swimming underwater, prior to coming the surface, put hands above head and splash the water surface to disperse oil, debris or flames.

(3) If there is danger of underwater explosion, float or swim on the back as near the surface of the water as possible. In cold water, forming close circles with others will preserve heat.

(R

(4) Stay with other persons in the water to reduce danger of sharks and make rescue easier.

(5) If ship is sinking rapidly, swim clear promptly, and tow injured persons clear, to avoid suction effect.

g. Follow all other procedures/precautions as delineated in the ship's Abandon Ship Bill.



## CHAPTER D12

### PAINTING AND PRESERVATION

#### D1201. DISCUSSION

a. Most paints, varnishes, lacquers, cleaners, solvents, and other finishing materials contain flammable solvents and, therefore, present a fire hazard. In addition, these same products frequently give off toxic vapors which are harmful. For this reason, paints and similar products are not carried aboard submarines. Chipping causes scale to be dislodged, presenting possibility of eye or facial injury. It is therefore necessary that proper precautions be taken in handling and using these products. See Naval Ships Technical Manual, Chapter 631, Painting and Preservation of Ships for detailed procedures and precautions. (R)

b. Paint removal has been shown to produce extremely high personnel exposures to substances found in paints. Administrative and protective measures need to be followed to lessen the amount of dust from sanding, grinding, and chipping of surfaces coated with (or potentially coated with) lead or chromate based paints and from fumes generated during hot operations. (A)

#### D1202. SAFETY PRECAUTIONS FOR SURFACE PREPARATION AND PAINTING OPERATIONS

a. Wear safety goggles and full faceshield and long sleeve shirts with sleeves rolled down and all buttons buttoned at all times while chipping or operating power brushes, chipping, or scaling tools. Particulate air-purifying respirators shall be worn for all chipping, scaling, and sanding operations, except if the paint being removed is known or suspected of containing lead. If lead-based paint is to be removed, an industrial hygienist should evaluate the operation and recommend proper respiratory protection and other personal protective clothing. See Chapter B10. (R)

b. All paint brought onboard ship shall be logged in the atmosphere control log and shall be approved by the executive officer.

c. Do not paint in any area where welding is being performed.

d. Do not use electric power wire brushes and chipping tools over the side.

e. Wear emergency air breathing masks when engaged in spray painting operations internal to the ship or in confined external areas (free-flood areas). Supplied air respirator may be required for extensive external spray paint operations. For minor external spray painting and touchup of small areas, an organic vapor cartridge type with paint mist pre-filter may be used. If a paint containing or suspected of containing lead is being used, an

industrial hygienist should evaluate the operation and recommend proper respiratory protection and other personal protective clothing. See Chapter B10.

NOTE

Aerosol paint cans are not permitted within the submarine for use or storage.

f. When working over the side or aloft, see Chapter D4 of this manual for additional precautions.

g. Only 1 day's amount of paint in the area being painted shall be brought below decks. Full-strength ketone solvents shall not be brought below decks.

R) h. Paints, brushes, and stirring sticks should not be stored on the pier for extended periods of time.

i. Do not smoke when painting. Post "NO SMOKING" signs in the area(s) being painted. If painting with vinyl, saran, or other explosive or toxic vapor paints, the following additional precautions shall be followed:

(1) Fly the BRAVO flag from the sail.

(2) No smoking shall be permitted on board, topside, or below decks.

(3) No smoking or hot work shall be permitted within 50 feet of the ship. Signs shall be posted on the pier "DANGER-SPRAYING WITH VINYL."

(4) Adjacent ships shall be notified.

(5) Take precautions to prevent vapor pocketing in low points. Shut and dog hatches. Shut induction and exhaust valves.

(6) Painters shall be supervised by a petty officer.

(7) Organic vapor cartridge respirators with paint mist prefilter shall be worn by all personnel within 15 feet of vinyl painting or mixing operations.

(8) Painters shall have no spark-producing materials on their person.

(9) Spray guns shall be grounded.

j. Provide ventilation in closed areas when painting.

k. Wear rubber gloves when handling cleaning compounds, thinners, paints, removers, or other irritants.

1. De-energize all equipment in areas being painted.
- m. Explosion proof lighting must be provided during spray-painting operations.
- n. Remove all paints and thinners from the ship when taking a lengthy break. Upon completion of painting, properly dispose of unused paint and waste.
- o. Wear rubber insulating gloves when using portable, electric powered tools. See Chapter D5 of this manual for additional precautions when using electrical power tools.
- p. Many paints, paint cleaners, solvents and brush cleaners are hazardous materials. Refer to Chapter D15 of this manual for hazardous material storage, use, and disposal procedures.
- q. Many paint removal tools are noise-hazardous equipment. If so labeled, ensure that proper hearing protective equipment is worn. See Chapter B4 of this manual for additional information.
- r. All internal painting with oil based paints should be terminated 5 days prior to sealing the ship. Painting with latex or water based paint should be terminated 3 days prior to sealing the ship.
- s. Paint mixing shall be performed on the pier adjacent to the ship. Posted barricades shall be provided to ensure there is no smoking, open flame, or hot work in the vicinity of the paint mixing area.
- t. Personnel with a history of chronic skin disease or allergies shall not be permitted to work with paint compounds or thinners. Personnel who are sensitive to paint compounds and thinners shall be reported to the medical department for evaluation.
- u. No food or drink shall be allowed in the paint area. When painting materials are handled, care shall be taken to wash hands prior to eating, drinking, smoking, or using the head.
- v. When painting engineering spaces, they should be in a cold-iron condition before and during paint application. Heat-producing work areas adjacent to where brush/roller application of paint is being performed may be considered, provided that:
  - (1) The painting operation involves only minor (touchup) operations.
  - (2) There is no hot work within 25 feet of painting operation while using surface ventilation lineup, unless separated by a water tight bulkhead.

A) **D1203. SAFETY PRECAUTIONS FOR PAINT REMOVAL**

a. Shipboard paint removal by ship's force shall not be performed for cosmetic reasons or due to excessive thickness.

b. Shipboard paint removal by ship's force should only be done when required to accomplish preservation of corroded surfaces, incidental to hot work, welding, or when bare metal is necessary for an inspection.

c. Mechanical grinding and sanding shall be kept to the absolute minimum with primary reliance on impact tools and authorized chemical paint strippers for paint removal.

d. Assume all paint contains substances, such as lead or chromate, which are hazardous to your health if ingested or inhaled in small amounts, unless proven otherwise by sample analysis. (See Chapter B10 for sample analysis procedures).

e. Personal protective equipment (PPE) contained in AEL 2-330024045, asbestos rip-out kit, may be used for paint removal, provided an inventory is maintained.

f. Ensure that all personnel involved in paint removal wear disposable coveralls, gloves, and other PPE as required.

g. Follow the requirements of Chapter B6 regarding the use and care of respirators.

h. Lead or chromate contaminated paint debris shall be treated as hazardous material and controlled and disposed of accordingly.

i. Secure and cover all deck drains and installed ventilation systems and openings in the paint removal work area. Isolate the work area to the maximum extent possible with drop cloths and/or plastic.

j. At the end of the work shift personnel shall vacuum debris and all surfaces in the area with HEPA-equipped vacuum cleaner. Coveralls and gloves shall be vacuumed prior to removal.

k. Personnel shall minimize the use of water during paint removal, since any used in the operation must be treated as hazardous material.

l. Ensure that paint debris, HEPA filters, and wipe down rags are separated from coveralls, gloves, and other disposable materials. Place them into plastic bags and label both groups as hazardous materials.

m. Tools and surfaces in the work area shall be wiped down after completion of the task.

## CHAPTER D13

### FOOD PREPARATION AND SERVING FACILITIES

#### D1301. DISCUSSION

A basic necessity for any ship is a galley. The crew must be fed and personnel must prepare food for consumption. The food preparation required to feed a large body of people means that machinery and equipment must be used. The use of this machinery introduces hazards unique to the galley and food-preparation areas. Additional precautions may be found in references D13-1 and D13-2.

#### D1302. GENERAL PRECAUTIONS

Before attempting to operate machinery, observe the following general precautions:

- a. Check for and determine the location of emergency equipment, such as fire extinguishers and first aid boxes, to ensure their availability should an accident occur. Report any deficiencies or malfunctioning equipment to the supervisor.
- b. Make sure that the area around the equipment is clear of obstructions and thoroughly dry. Cleanup all spills immediately to ensure a clean, dry, non-slippery working surface.
- c. Ensure that the installed lighting in the work area is operating properly and provides sufficient light.
- d. Observe and follow posted operating instructions and safety precautions.
- e. If there is any doubt about operating procedures or safety precautions, ask your supervisor.
- f. Unauthorized personnel shall not attempt to operate equipment.
- g. Be certain no loose gear is in the vicinity of moving parts of machinery. Make sure that all safety guards, screens, and devices are in place before turning on machinery.
- h. When operating a machine, maintain a safe distance from all moving parts. Never use your hands or body to stop moving blades and parts even though power has been turned off.
- i. Never lean against a machine while it is operating.

j. If ship movement is severe, exercise caution in operating machines; if severe movement continues, turn off nonessential machines.

k. Use safety equipment such as protective gloves, safety glasses, and dip baskets while handling chemicals or hot water.

l. Keep your hands, body, and clothing away from operating machine parts.

m. Never leave operating machinery unattended.

n. Do not distract the attention of personnel who are operating machines.

o. Do not attempt to clean or service a machine while it is in operation. Before cleaning, adjusting, oiling or greasing equipment, be sure power is turned off and equipment is DANGER tagged.

p. Ensure that all repairs and servicing are made only by authorized personnel.

q. Make sure safety devices, such as safety interlocks on galley equipment (i.e. the cover of a dough-mixing machine), are maintained in proper working condition at all times. If removed for any reason, such devices must be replaced before the machine is returned to operation.

r. Remove rings and watches, and eliminate any loose clothing such as rolled-up sleeve cuffs, oversized gloves, and ill-fitting coats and jackets.

s. Ensure that permanently mounted equipment is hardwired (extension cords are not permitted).

t. If the ship will be taking steep angles (a planned evolution), ensure that the level of liquid (grease or water) in pots and other containers is sufficiently low that it will not overflow its container during the maneuvers. During normal operations, container liquid levels should be maintained as low as possible, to avoid injury due to unexpected ship angles.

#### D1303. COOKING UTENSILS

a. Make certain that all heavy items, knives, and other sharp tools are securely fastened and stowed in racks to prevent injury to personnel.

b. Secure all coffee pots and urns to prevent dislodging and splashing.

c. Exercise extreme caution and care when handling hot oils, water, and other liquids or when operating steam valves and equipment. Do not transfer hot liquids in heavy or moderate sea states or when planning to take steep angles.

d. Never leave drawers, doors, or access panels open where they could become hazardous to personnel.

- e. Never leave hot plates, pots, griddles, or fryers unattended.
- f. Be careful not to place meat, vegetables, or other foods on a knife or other sharp instrument. The food may conceal the cutting edge.
- g. Do not place knives in the wash water until ready to wash them. Lay them in plain view beside the sink.
- h. Keep your free hand away from the sharp edge of the cleaver when chopping foods.
- i. Use a metal glove when boning meat.
- j. Use a scoop or perforated serving spoon to handle shrimp.
- k. Store utensils in their proper places.
- l. Do not allow pot/pan handles to extend beyond the edge of the range or counter. They can be bumped and cause serious burns to personnel resulting from spilled or splashed food or liquid.
- m. Before removing foods from hot ranges and ovens, be sure there is a clear place on which to set them.
- n. Use only the proper implements for opening cans and other containers.
- o. Hold knives firmly. Ensure knife handles are dry or free of grease before handling them.
- p. Only keep knives in a rack designated for this purpose.
- q. Magnetic knife racks are prohibited due to knife magnetism picking up foreign material.
- r. Keep knives sharp at all times.
- s. Never handle a knife while carrying another object.
- t. Ensure hot pads are clean and dry.
- u. Keep all tools clean and dry.

D1304. FOOD PREPARATION

- a. Practice good personal hygiene at all times, and report all illnesses and injuries to your supervisor.
- b. Keep your hands clean.
- c. Keep fingernails short.

- d. Wear appropriate hair covering at all times in food-handling areas.
- e. Do not touch food with your hands unless necessary. Use appropriate implements for handling food when possible.
- f. Never handle food when you have an infection of any kind on your hands or arms. If you develop a sore throat, cold, intestinal disturbance, or symptoms of other general disease, report to the corpsman at once.
- g. Clean up spilled food immediately.
- h. Do not use leftovers held over 36 hours.
- i. Ensure that distant-reading dial thermometers and, when required, electronic temperature-monitoring units are installed and operating. Verify thermometer accuracy monthly. Ensure the emergency door-release mechanism required in "walk-in" refrigerators and freezers is installed and properly operating.
- j. Discard protein foods that have remained at temperature between 40 degrees Fahrenheit and 140 degrees Fahrenheit longer than 3 hours.
- k. Observe safety precautions around all electrical equipment to avoid injury from shock.

D1305. SAFE OPERATION OF EQUIPMENT

a. Deep Fat Fryer

- (1) Beware, this is high voltage equipment.
- R) (2) Extinguish a fire in the deep fat fryer in accordance with NSTM, Chapter 555.
- (3) Never leave fryer unattended when in use.
- (4) If solid fat is used, do not allow large pieces to drop on heating units or thermostat bulb.
- (5) Whenever possible, melt solid cooking oil or fat prior to putting into deep fat fryer.
- (6) Ensure heating coils are completely covered with fat before turning on the equipment.
- (7) Never exceed the maximum temperature noted by manufacturer.

(8) Monitor cooking oil temperature with a proper thermometer whenever the deep fat fryer is in use. Ensure back up safety thermostat is installed and operational. (R)

(9) Install cover when fryer is not in use.

(10) Secure deep fat fryer following posted instructions when not in use.

(11) Ensure that grease spills are cleaned up promptly.

(12) Grease filters in range hoods shall be washed and changed as often as necessary, but not less than weekly, to avoid the danger of fire. (A)

b. Dough Mixing Machine

(1) Never attempt to cut dough while the agitator is revolving.

(2) Never attempt to knead or feel consistency of dough product while machine is in operation.

(3) Never attempt to clean out a bowl in the tilt position by reaching in unit while the agitator is revolving.

(4) Check safety switch to lid cover for proper functioning in accordance with PMS.

c. Food Mixing Machine

(1) Use proper machine speed for the specific operation.

(2) Never place hands into the bowl while machine is in operation.

d. Vegetable Cutting and Slicing Machine

(1) Always use plunger when applying pressure on vegetables being fed into the hopper.

(2) Do not use loose-fitting gloves when operating the machine.

e. Meat Slicing Machine

(1) Never operate the machine unless the blade guard is secured in place.

(2) Do not use hands to press down food.

(3) Never touch the blade when it is running or exposed for slicing.

(4) Set index at zero and secure power at the distribution box or by pulling the plug when cleaning blade.

(5) Ensure slicing machines are provided with a toggle switch guard.

(6) Always disconnect power cord prior to cleaning and reconnect only when ready to use.

R) (7) Clean the blade with a clean, detergent-soaked cloth wrapped around a cook's fork or other extension utensil. Rinse the blades following a similar procedure and sanitize them with a disinfectant approved for use aboard submarines, e.g., Disinfectant-detergent, General Purpose, NSN: 6840-00-292-9698.

(8) Reassemble machine after cleaning.

f. Steam Kettle

(1) Each day this equipment is used, test the safety relief-valve while under operating pressure by pulling the chain attached to the safety relief valve arm.

(2) Do not tamper with the safety-valve or tie it closed. It is there to prevent the kettle from exploding.

(3) Do not apply steam to an empty kettle; never put water into a hot, dry kettle.

(4) Ensure safety relief-valve levers are equipped with an 18-inch chain to allow activation from a safe distance. Chains must be mounted in such a way that the need to reach over or between/behind hot kettles is eliminated.

(5) Ensure steam-jacketed kettles are hydrostatically tested as required by the equipment Maintenance Requirement Card (MRC).

A) (6) Piping from relief valves shall extend to just inside the deck coaming.

A) (7) Lagging under steam kettle shall be removed and replaced with perforated steel or aluminum with approximately 1/2-inch stand off.

g. Electric Griddle

(1) Keep griddle turned off when not in use.

(2) Keep cooking surface and grease gutter scraped and wiped clean at all times.

- (3) Remove, empty, and clean grease drawer after each use.
- (4) Use griddle guards to keep food from sliding off the cooking surface.
- (5) Never use water to clean a griddle surface. Wipe the surface with clean, dry paper towels when the griddle is cold. Use pumice stone block to clean hard-to-remove burn spots.

h. Coffee Urn

- (1) Do not introduce water too quickly into the boiler.
- (2) Do not overfill boiler. Be sure water has stopped rising in the gage glass after the water-inlet valve is closed. Do not turn on activating switch until water-level gage reads full or the pressure control dial reads 36 ounces.
- (3) Do not open urn cover while siphon valve is open. Do not agitate coffee while cover is open. Do not remove leacher from the urn body until it is completely drained.
- (4) Do not obstruct safety-valve outlet. Keep equipment clean. Clean the urn immediately after use to prevent development of rancid taste.

i. Ranges and Ovens

- (1) Do not allow grease to collect in oven.
- (2) Do not clean oven while it is hot.
- (3) Clean oven thoroughly once a week in addition to normal daily cleaning.
- (4) Turn off surface units when not in use.
- (5) Keep range drip-pan and grease trough clean. Never allow grease to accumulate since it is a serious fire hazard.
- (6) Observe the electrical wiring under the range griddle/hot plate to see if wiring is secured in place and not chafed or in contact with the grease drip-pan. DO NOT attempt to correct faulty wiring yourself. Call an electrician to do it.

j. Proofer

- (1) Only authorized personnel are permitted to operate this equipment.
- (2) Clean the proofer after each use.

k. Dish Washing Machine. Observe operating instructions and safety precautions.

l. Steam Table

(1) Use the proper implements, such as pot holders and tongs, for handling the containers.

(2) Tilt containers away from you when inserting them into the wells.

(3) Carry hot liquids in covered containers with the covers securely in place.

(4) Promptly mop up grease which is spilled on the deck. Greasy decks are doubly hazardous. They can cause fires as well as falls.

m. Garbage Grinder (not applicable to pre-726 class submarines)

(1) Do not put hands into grinder when in operation.

(2) Start grinder and turn on water before feeding waste.

(3) Feed food waste gradually.

(4) Do not feed metal, wood, cloth, rubber, plastics, or corn husks into the garbage grinder. If such material is fed accidentally, stop grinder immediately and remove object after disconnecting power. Do not feed bones larger than 1/4 inch in diameter for the 400-pound/hour model or larger than 1 inch in diameter for the 1,600-pound/hour model into the grinder.

n. Gaylord Exhaust Hoods

(1) The fire extinguisher control box contains a live electrical circuit. Prevent water or other cleaning fluids from entering this box.

(2) The baffle blades and interior of hood should be cleaned at least once a day to prevent fires from accumulation of grease.

(3) Keep the access doors closed during the wash and rinse cycles to prevent hot water from splashing personnel.

(4) Keep hood drains clear at all times.

o. Trash Compactor. Refer to Chapter D8 for precautions on the operation of the trash compactor.

p. Meat Chopping Machine

(1) Never feed this equipment by hand. Use a pestle (stomper).

## CHAPTER D14

### LAUNDRY MACHINES AND PHOTOGRAPHY

#### D1401. DISCUSSION

Hazards in laundry equipment and the photographic darkroom include mechanical equipment, toxic chemicals, electric power, and heat. Safety precautions contained in this chapter are basic and general.

#### D1402. PRECAUTIONS RELATING TO LAUNDRY EQUIPMENT

##### a. Washer Extractor

(1) Thoroughly examine all clothes before cleaning; remove all foreign materials such as matches, ink pens, and metallic objects.

(2) Make certain that the cylinder door is firmly latched before operating the machine.

(3) Do not exceed the prescribed loading capacity of the cylinder; doing so may damage the machine or prove hazardous to personnel.

(4) Be sure the machine is entirely disconnected from the circuit before cleaning or servicing. Use safety tag-out procedures as required by PMS and the submarine force tag-out program.

(5) Make sure safety devices, such as the safety interlock on cover, are maintained in proper working condition at all times. If removed or out of order for any reason, replace safety devices before the machine is put into operation.

(6) Do not exceed the recommended detergent amount for load size being washed. Excessive soap may cause skin irritation. (A

(7) Ensure safety precautions and operating procedures are posted. (A

##### b. Tumbler Dryer

(1) Turn off power prior to loading and unloading machine.

(2) Never overload the machine.

(3) Never open the door while the tumbler is in motion.

(4) Before servicing or cleaning, be sure the power to the tumbler dryer is entirely disconnected. Use safety tag-out procedures as required by PMS and the submarine force tag-out program.

(5) Safety devices shall be maintained in proper working order at all times. If removed for any reason, they shall be replaced before machine is put into motion.

(6) Ensure that the primary lint screen is checked and cleaned as required prior to use and after every drying cycle. Ensure the secondary lint filter is cleaned after every 4 hours of operation.

(7) Ensure someone is watching the machine while it is running. It is a fire hazard.

A) (8) Ensure safety and fire prevention precautions and operating procedures are posted.

A) (9) Never allow the dryer temperature to exceed 160 degrees Fahrenheit.

**D1403. PRECAUTIONS FOR PHOTOGRAPHIC DARKROOMS**

a. Wear appropriate personal protective equipment when mixing and handling photographic chemicals. Follow guidance contained in D-15 for all photographic chemicals.

b. Ensure a method for hand and face wash is provided and used in all chemical mixing areas. For eye-wash requirements, see eye wash data in Chapter B5.

c. Avoid skin contact with chemicals.

d. Carry out meticulous housekeeping policies in all chemical mixing areas.

e. Make acid-type hand cleaners available in chemical mixing and chemical handling areas.

f. Use print tongs, clips, hangers, and stirring rods instead of fingers, or wear rubber gloves when handling films and papers in solution.

g. Familiarize yourself with the hazards of E-6 chemistries.

h. Clean rubber gloves and personal clothing at frequent intervals. Replace gloves when wear or swelling occurs.

i. Properly store photographic chemicals.

(2) Never attempt to remove anything from these machines while they are operating.

(3) Always disconnect the machines before cleaning them.

r. Meat Tenderizing Machine

(1) Never place your hands near the feed slot when feeding material into this machine.

(2) Avoid wearing loose fitting gloves.

s. Potato Peeler

(1) Make sure water is running before operating this equipment.

(2) Never put your hand in this machine while it is operating.

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Chapter D13

REFERENCES

D13-1 NAVMED P-5010, "Manual of Preventive Medicine", Chapter 1.

D13-2 COMSUBLANT/COMSUBPAC INST 6000.2, "Standard Submarine Medical Procedures Manual", Chapter 6.

j. Provide separate storage for chemicals which react violently with each other.

k. Learn the darkroom layout with white lights on.

l. Take care when entering or leaving the area because of the rapid change of lighting and the temporary blindness this causes.

m. Inspect all electrical connections frequently for damage and fraying. Ensure that all electrical equipment is properly grounded, has been safety-checked, and approved electrical plugs are used.

n. Never touch an electrical plug, switch, or any part of an electrically-operated machine with wet hands or while standing on a wet deck.

o. Use rubber mats with appropriate electrical ratings around equipment that could cause electrical shock.

p. The photographic chemicals, 1,1,2 Trichloroethane and 1,2,2 Trifluoroethane, shall not be used.

q. Flash Equipment

(1) Severe electrical shock is the hazard to guard against when using electronic flash equipment. Stored energy in photographic electronic flash units can be lethal (some units operate from voltages as high as 4,000 volts). Use caution whenever operating this equipment.

(2) Repair of electronic flash equipment shall be done only by those thoroughly familiar with the equipment. The storage capacitors may have a large charge at high voltage and can be discharged at high amperage which may be lethal.

## CHAPTER D15

### HAZARDOUS MATERIAL STORAGE, USE AND DISPOSAL PRECAUTIONS

#### D1501. DISCUSSION

Special precautions are required for the stowage, handling, and use of hazardous materials (HM) aboard ship. Significant hazards include fire, poisoning by breathing toxic substances in unventilated spaces, dermatitis, asphyxiation, and burns of the skin and eyes. Some materials normally thought to be safe may become hazardous under certain use or storage conditions. This chapter contains general precautions for stowage and use of all HM, precautions for subcategories of HM (flammable materials, toxic materials, corrosive materials, oxidizers, aerosol containers, and compressed gases) and specific precautions for certain selected materials. Related information is in Chapter B3, which describes a HM control and management program including procedures for purchase, receipt, issue, and disposal of HM; responding to HM spills; obtaining material safety data sheets (MSDS); and training personnel on HM.

#### D1502. GENERAL STORAGE REQUIREMENTS

The following general precautions must be observed to minimize hazards inherent in the handling and storage of HM:

- a. Mark stowage locations to identify type of HM stored and keep the location/materials clean and dry at all times.
- b. Provide ventilation in HM stowage areas, where appropriate. Ventilation of tanks shall be continued until the gas free engineer certifies they are safe for reentry.
- c. Allow only authorized personnel access to stowage locations, where appropriate.
- d. When transferring material from one container to another, ensure that existing precautionary labeling is retained and that subsequent containers are marked with appropriate precautionary labeling. DD 2521 or DD 2522 may be used for labeling of containers into which HM is transferred. (R)
- e. Do not transfer material to a container that has previously stored a different material without first checking the materials' compatibility. (A)
- f. Stow HM only in a container which is compatible to the material (e.g., do not place corrosive materials in metal drums). (A)
- g. Stack containers in such a way that they will not crush lower containers, become imbalanced, or be difficult to access.

- h. Use material on a first-in, first-out basis, considering shelf life.
- R) i. Prohibit smoking, eating, or drinking in stowage areas. Signs shall be posted indicating these requirements.
- j. Ensure that open flames or spark-producing items are not permitted in stowage areas.
- k. Conduct monitoring of hazardous material-stowage areas using guidance in the Atmosphere Control Manual as a part of the ship's routine atmospheric analysis and any time a question arises as to the safety of such stowage locations.
- l. Seal and protect all containers against physical damage and secure for heavy seas.
- m. Maintain explosion-proof electrical fixtures in proper condition in appropriate HM/HW stowage areas.

**D1503. GENERAL HANDLING AND USE REQUIREMENTS**

- R) The *Hazardous Material User's Guide* provides information on the handling and use of 20 HM groups. This guide should be consulted for precautions on handling and use of HM within these groups. Observe the following general requirements when handling HM:
- R) a. Work center supervisors shall ensure that, prior to using any hazardous material, personnel under their supervision are trained on the hazards associated with that material and that they have been provided with necessary protective clothing and equipment (i.e., eye protection, respiratory devices, and gloves appropriate to the HM in use).
- b. Work center supervisors shall ensure that adequate ventilation exists in all spaces where hazardous materials are used, that such systems are in good operating condition, and that they have been evaluated as adequate by an industrial hygiene survey team.
- c. Upon completion of hazardous material use, return surplus material to its appropriate storage location.
- d. Avoid breathing vapors or dust when using hazardous materials.
- e. Avoid contact with the eyes or prolonged contact with skin when using hazardous material.
- f. Prohibit smoking, drinking, or eating in areas where open containers of hazardous material are being used.

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g. Ensure personal protective equipment (eye protection, respiratory devices, gloves appropriate to the HM in use, etc.) is in good operating condition and is readily available to all personnel working with HM. (R)

h. Ensure personal protective equipment (eye protection, respirators, gloves appropriate to the HM in use, etc.) is in good operating condition and is readily available to all personnel working with HM. (R)

i. Before entering spaces that have been closed for significant periods of time, have the ship's medical department representative (MDR) determine that atmosphere is safe for entry for ship's force personnel only. For all other Navy personnel, other than the ship's force, a qualified Gas Free Engineer is required to determine if the space is safe for entry.

j. Use a respirator with appropriate filter when potentially exposed to particulate matter, hazardous gases, or vapors. Consult the MDR for specific guidance in this regard, and for a determination of the need for more stringent respiratory protection requirements.

k. Do not add incompatible materials to the same collection container. (A)

D1504. FLAMMABLE AND COMBUSTIBLE MATERIAL (R)

A flammable material is any solid, liquid, vapor, or gas which will ignite easily and burn rapidly. A flammable liquid is defined by the National Fire Protection Association (NFPA) as a liquid with a flash point below 100°F and having a vapor pressure not exceeding 40 lbs./square inch. Liquids having a flash point at or above 100°F are combustible liquids. All flammable and combustible liquids pose a danger to personnel and the ship, particularly those liquids having flash points below 200°F. Never carry flammable or combustible liquids aboard ship in quantities in excess of that required. Stow flammable and combustible liquids in approved locations. Dispense flammable and combustible liquids from shipping containers only into safety cans or other approved portable containers. Never use flammable or combustible liquids near a heat source or spark-producing device. (R)

a. Storage Requirements

(1) Store flammable and combustible materials following precautions listed in paragraph D1502.

(2) Flammable and combustible materials shall be stored separately from oxidizing materials (i.e., sodium nitrate, calcium hypochlorite, potassium permanganate, peroxides, and strong inorganic acids (nitric, hydrochloric, and sulfuric acids)), (see Appendix D15-A: Hazardous Material Compatibility Storage Diagram). (A)

(3) Store a maximum quantity of 12 gallons of any one type of material with a flash point greater than 200 degrees Fahrenheit, but less than 1500 degrees Fahrenheit (excluding grease), in an area designated by the engineering officer. The containers shall not be stowed within 3 feet of any surface where the temperature may exceed 140 degrees Fahrenheit. More than 12 gallons of grease may be stowed in one location (in original containers and greater than 3 feet from 140 degrees Fahrenheit surfaces).

(4) Ships not having flammable/combustible-liquid lockers shall store all items with a flashpoint less than 200 degrees Fahrenheit, solids and semi-solids which give off flammable vapors, solids which burn with extreme rapidity because of self-contained oxygen, and materials which ignite spontaneously when exposed to air in a manner which minimizes fire hazards until such time as flammable/combustible-liquid lockers are made available.

(5) Ensure combustible materials such as rags, paper and wood are not stowed in the same area as flammable materials; however, oily rags should be stowed in these areas after being placed in suitable containers.

(6) Prohibit open flames or spark-producing items in the vicinity of flammable stowage locations.

(6) Ensure containers are secured with metal banding or other approved tie-downs vice manila line.

b. Handling and Usage Requirements

R) (1) Handle and use flammable materials per the precautions listed in paragraph D1503. Many flammable and combustible materials have additional hazardous properties, such as toxicity. See also Section D1505.

(2) Never use flammable material near a heat source or a spark-producing device. Do not smoke in an area in which flammable material is being used. Designate spaces in which flammable materials are being used as NO SMOKING areas.

(3) Keep scrapings and cleaning rags soaked with flammable or combustible liquids in a covered metal container until the hazardous material is disposed of properly.

(4) Keep suitable fire extinguishing equipment and materials ready at all times for instant use.

A) (5) Ensure that containers of partially-used flammable materials are returned to proper stowage facilities, are tightly closed, and are properly labeled.

**D1505. TOXIC MATERIAL**

A toxic substance has the inherent capacity to produce personal injury or death through ingestion, inhalation, or absorption through any body surface. Toxic materials are considered, and often marked by the manufacturer as being, poisonous. Avoid contact with toxic materials by using suitable protective clothing and following safe handling procedures. Ships must, in order to achieve their missions, carry some toxic material, and personnel will be called upon at times to use them. Solvents, degreasers, and refrigerants are but a few of the toxic materials that may be found aboard ship. If stowed, handled, and used in the proper manner, they present little or no danger.

**a. Storage Requirements**

(1) Store all toxic material per the precautions listed in paragraph D1502. Many toxic materials have additional hazardous properties, such as flammability or combustibility. See also section D1504. (R)

(2) Store all toxic material in cool, dry, well-ventilated locations separated from all sources of ignition, acids and acid mists/vapors, caustics, and oxidizers, (see Appendix D15-A: Hazardous Material Compatibility Storage Diagram). (R)

(3) Seal all containers and protect them against physical damage.

**b. Handling and Usage Requirements**

(1) Handle and use toxic materials per the precautions listed in paragraph D1503. (R)

(2) Use appropriate gloves and protective clothing when handling sensitizers or potential skin irritants such as epoxy and polyester resins and hardeners where significant skin contact is likely. Protective skin cream shall only be used to supplement, but not replace the appropriate gloves for any operation where significant contact work with potentially toxic/irritant/sensitizing materials is likely. (R)

**c. Halocarbons (Refrigerants).** Liquid or gaseous halocarbons have multiple applications in the Navy. They are used as refrigerants, solvents, and dielectric fluids and as line flushing, and degreasing agents. With common names of refrigerant R-11, R-12, R-22, R-113, R-114, and R-116, these products may be better known by names such as FREON<sup>®</sup>, ISOTRON<sup>®</sup>, FRIGEN<sup>®</sup>, FLUORANE<sup>®</sup>, FREON MF<sup>®</sup>, FREON TF<sup>®</sup>, GENSOLV D<sup>®</sup>, BLACO-TRON TF<sup>®</sup>, and ARKLONE P-113<sup>®</sup>.

(1) To minimize the size of spills, procure, store, and use halocarbons in the smallest amount and container possible for an operation.

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(2) All normally-used halocarbons are stocked in the Naval Supply System and should be procured only through that system.

R) (3) Prohibit smoking and hot work in areas or vicinity where halocarbons are being used.

(4) Prohibit storage and consumption of food and tobacco in areas where halocarbons are being used.

(5) Some types of FREON<sup>®</sup> are nearly odorless and can numb the sense of smell.

(6) Only use FREON-113<sup>®</sup> as a solvent when specified and when such use is essential. It may not be stored or carried aboard (see 1,1,1-trichloroethane below).

(7) For system filling or flushing:

(a) Establish constant communications between personnel manning the halocarbon pumps and the equipment being serviced.

(b) Ensure adequate warning signs are posted around the area and access to area where halocarbons are being used. Warning signs should state:

VAPORIZATION OF THIS PRODUCT CAN DISPLACE OXYGEN NECESSARY FOR BREATHING AND MAY CAUSE SUFFOCATION WHEN IN CLOSED SPACES OR AREAS WITHOUT VENTILATION. HEATED VAPOR CAN PRODUCE TOXIC GASES. EXPOSURE TO HIGH CONCENTRATION CAN CAUSE HEART IRREGULARITIES OR DEATH.

(c) Verify filling- and flushing-system integrity with a pressure drop test. Do not over-pressurize the system during the test.

(d) Install supplemental exhaust ventilation at the point of vapor generation.

(e) Vent purge overboard so as to avoid recirculation.

(f) Provide emergency air-breathing masks (EABs) in areas where halocarbons are used. Use EABs in the event a halocarbon spill occurs and personnel must remain in the space due to operational requirements.

(g) Monitor ship's spaces (halocarbons and oxygen) with atmosphere-analyzer equipment to ensure it remains safe for work.

(h) Provide personal protective equipment (chemical goggles, full-length face shield, neoprene gloves, and apron).

(i) Assign a minimum of two men to this evolution.

Enclosure (1)

D15-6

(j) Shipyards and Intermediate Maintenance Activities (IMAs) provide Emergency Escape Breathing Devices (EEBDs) for their personnel working on submarines. When maintenance procedures require the EAB air system to be secured, the supporting shipyard/IMA shall provide EEBDs and training to ship's force prior to commencing work.

d. Toxic Cleaning Solvents. Toxic cleaning solvents such as 1,1,1-Tri-chloroethane may not be stored or carried aboard. Solvent cleaning will not be attempted except alongside a pier or tender. Solvent cleaning will not be used until mechanical cleaning has failed or is technically impossible (for example, FREON® flushing of O<sub>2</sub> piping). Only prescribed cleaning solvents with a flashpoint greater than 140 degrees Fahrenheit are authorized for use. Diesel fuel and other solvents will not be sprayed as a cleaning agent. When cleaning solvents are used, use explosion-proof mechanical-exhaust ventilation to exhaust vapors overboard to prevent reentry and recirculation. The ventilation rate (cubic feet per minute) and any other control measures will be determined by the cognizant tender industrial hygienist (safety officer) or the supporting shore activity's shore maritime gas free engineer.

#### D1506. CORROSIVE MATERIALS

Corrosive materials are chemicals, such as acids, alkalies, or other liquids or solids which, when in contact with living tissue, will cause severe damage to such tissue by chemical action. In case of leakage, corrosive material will materially damage surfaces or cause fire when in contact with organic matter or with certain chemicals. (R)

##### a. Storage Requirements

(1) Store all corrosive materials per the precautions listed in paragraph D1502. (R)

(2) Store corrosive materials in their original containers.

(3) Ensure that corrosive materials are not stored in the vicinity of oxidizers or other incompatible materials, (see Appendix D15-A: Hazardous Material Compatibility Storage Diagram). (R)

(4) Ensure that acids and alkalies are stowed separate from each other. (A)

##### b. Handling and Usage Requirements

(1) Handle and use corrosive materials per the precautions listed in paragraph D1503. (R)

(2) Wear chemical goggles and full face shields, rubber gloves, rubber boots, and aprons when handling acids or other corrosive materials.

(3) Never allow corrosive materials or their vapors to come in contact with the skin or eyes.

c. Inorganic Acids

(1) Stow liquid inorganic acids such as hydrochloric, sulfuric, nitric and phosphoric acids bottled in glass or plastic in such a manner that they are cushioned against shock. They should be kept in their original shipping carton or box inside suitable acid-resistant lockers, cabinets, or chests.

(2) Maintain hydrofluoric acid in acid-proof polyethylene or ceresin-lined bottles at all times and never allow them to come in contact with skin or eyes.

(3) Do not stow inorganic acids in the vicinity of flammable liquids.

d. Organic Acids. Do not permit liquid and solid organic acids such as glacial acetic, oxalic, carbolic, cresylic, and picric acids to come in contact with the eyes or skin. These acids are corrosive to aluminum and its alloys, to zinc, and to lead. Keep these acids, usually packaged in glass bottles, from freezing and physical damage. Stow these acids in an approved acid locker lined with acid-resistant material, separated by at least three feet from all other material. Lockers shall be separated by a partition, or by at least 3 feet from all other material.

- A) e. Alkalies. Stow alkalies (bases), such as lithium hydroxide, sodium hydroxide, potassium hydroxide (lye), disodium phosphate, trisodium phosphate, sodium carbonate, and ammonium hydroxide (ammonia water) in designated lockers, cabinets, or chests. Keep alkalies separated from acids, oxidizers, and other incompatible materials. Ensure the stowage area is dry.

A) **NOTE:**

Many shipboard cleaning agents and laundry materials contain alkalies in very strong concentrations. Specified stowage and handling precautions for these materials must be observed.

D1507. OXIDIZERS

- R) An oxidizer is a material such as chlorate, perchlorate, permanganate, peroxide, or nitrate which yields oxygen readily to support the combustion of organic matter, or which may produce heat or react explosively when it comes in contact with many other materials. Higher temperatures increase the possibility of oxygen release from oxidizers and the possible initiation of fire. Heat shall be avoided when handling and storing oxidizers. Oxygen candles are oxidizers.

a. Storage Requirements

- (1) Store oxidizers following precautions listed in paragraph D1502.
- (2) Do not store oxidizers in an area adjacent to a torpedo room or small arms ammunition storage or heat source or where the maximum temperature exceeds 100 degrees Fahrenheit under normal operating conditions.
- (3) Ensure that oxidizers are not stored in the same compartment with easily oxidizable material such as fuels, oils, grease, paints, or cellulose products. Do not remove or obliterate labels. (R)

b. Handling and Usage Requirements

- (1) Handle and use oxidizers in accordance with precautions listed in paragraph D1503.
- (2) When transferring oxidizers to second containers, ensure that the second container is compatible with oxidizing material. Place appropriate hazardous material labels on the second container. (R)
- (3) Do not remove or obliterate warning labels from containers.
- (4) Ensure oxidizing materials are only handled or used by authorized personnel.

c. Calcium hypochlorite is a chemical substance used to provide the sanitizing and bleaching property of chlorine without requiring the handling of liquid or gaseous chlorine.

(1) The following precautions apply to the stowage of calcium hypochlorite:

(a) The ready usage stock of 6-ounce bottles issued to the Medical and Engineering Departments shall be stowed in a Medical Instrument and Supply Set Case, NSN 6545-00-131-6992, which shall be kept in a secured locker with ventilation holes, preferably located in the cognizant department office space. Under no circumstances shall the stock of calcium hypochlorite bottles be stowed in a machinery or nuclear space, berthing space, storeroom, or in the nucleonics laboratory areas. (R)

(b) Label all lockers, bins, and enclosures with red letters on a white background:

**HAZARDOUS MATERIAL, CALCIUM HYPOCHLORITE**

(c) Dispose of containers as used/excess hazardous material and replace when they exceed 2 years from the date of manufacture. (A)

(2) The following precautions apply when using calcium hypochlorite:

(a) Mix only with water.

(b) Do not allow to come into contact with paints, oils, greases, wetting agents, detergents, acids, antifreeze, alkalis, or organic and combustible materials.

(c) Do not remove or obliterate warning labels.

(d) Dispense only in clean, dry utensils and only in amounts required for immediate use.

(e) Avoid contact with skin and eyes.

(f) Ensure containers are not used for any other purpose.

(g) For external contact or if taken internally, follow the instructions printed on the container label or on the material safety data sheets (MSDS).

(h) No special firefighting precautions are required for fires caused by calcium hypochlorite.

D1508. AEROSOLS

Aerosol spray cans are prohibited aboard submarines except as specifically allowed by Appendix A of the Nuclear Powered Submarine Atmosphere Control Manual, NAVSEA S9510-AB-ATM-010/(U).

D1509. COMPRESSED GASES

Aboard submarines numerous cylinders of compressed gases will be found. Compressed gases are used for welding operations (oxygen and acetylene), in refrigeration and air-conditioning systems (FREON), and for purging various systems (nitrogen). Cylinders of compressed gases are potential explosion, fire, and health hazards if strict compliance with existing requirements are not met.

a. Storage Requirements

(1) General

(a) Only stow compressed gases in compartments and locations designated for cylinder storage, as shown in applicable plans for each ship. Whenever practical, stowage shall permit removal of any cylinder without disturbing other cylinders. Such locations shall:

1. Be kept free of flammable materials (especially greases and oils).

2. Be maintained at temperatures below 130 degrees Fahrenheit.

(b) Ensure that cylinder valve protection caps are in place. (R)

(c) Stow cylinders by date of receipt, and place into service in the order of receipt.

(d) Tag empty cylinders EMPTY, mark MT, and segregate from full or partially full cylinders.

(2) Ready Service

(a) The following gas cylinders are found aboard submarines:

1. Fire extinguishers (portable).

2. Fire-extinguishing cylinders permanently connected to fixed fire-extinguishing systems.

3. Gas and chemical canisters for oxygen breathing apparatus.

4. Welding cylinders.

5. Medical gas cylinders.

6. Cylinders containing refrigerants.

7. Disposable cylinders supplied as repair kit accessories (halide leak detector kits, for example).

8. Gas cylinders for the propulsion plant operations.

(b) Welding Cylinders. Observe the following special instructions and precautions regarding oxygen and fuel gas cylinders in ready service:

1. Install cylinders of gas in accordance with approved plans or specifications.
2. Fasten cylinders securely in a rack. Ensure acetylene cylinders are always stowed vertically. Securely fasten the rack, in turn, at the designated locations.
3. Never leave unstowed equipment unattended.
4. Return welding units to designated stowage as soon as work is complete.
5. Attach a card to each welding unit with the following instructions:

Return to (designated location) immediately on completion of work. Unit shall not be left unattended while away from above location. Unit is NOT SECURE while pressure shows on gauges, or cylinders are not firmly fastened to rack and properly stowed.

b. Handling and Usage Requirements

- (1) Never drop cylinders nor permit them to strike against one another violently.
- (2) Never use a lifting magnet or a sling (line or chain) when handling cylinders. If a crane or hoist is used, provide a safe cradle or platform to hold cylinders. Do not lift cylinders by valve-protection caps.
- (3) When returning empty cylinders, be sure that valves are closed and that valve outlet, if provided, and cylinder-valve-protection caps are in place.
- (4) Be sure that all cylinders are approved under DOT regulations. Non-magnetic cylinders are an exception.
- (5) Only refill cylinders when such action is specifically approved by the command.
- (6) Fill a cylinder only with the gas for which the cylinder has been specifically designated.
- (7) Do not remove or change the numbers or marks stamped into cylinders without the specific approval of the Defense General Supply Center.
- (8) Never use cylinders for rollers, supports, or for any purpose other than to carry gas.

- (9) Never tamper with the safety devices on valves or cylinders.
- (10) Never hammer or strike the valve wheel in attempting to open or close valves. Use only wrenches or tools provided and approved for this purpose. If valve cannot be turned using hand or proper tool, return the cylinder to supply activity.
- (11) Be sure that the threads of regulators or other auxiliary equipment are the same as those on cylinder-valve outlets. Never force connections that do not fit.
- (12) Do not use regulators, pressure gauges, manifolds, and related equipment that are provided for a particular gas on cylinders containing different gases.
- (13) Only repair or alter cylinders or valves when authorized by COMNAVSEASYS COM. If trouble is experienced, remove cylinder from service, tag as defective, and return to supply activity. Do not remove the stem from a diaphragm-type cylinder valve.
- (14) Never subject compressed gas cylinders, either in stowage or in service, to a temperature in excess of 130 degrees Fahrenheit. A direct flame should never be permitted to come in contact with any part of a compressed gas cylinder.
- (15) Handle cylinders carefully. Rough handling, knocks, or falls are liable to damage the cylinder, valve, or safety devices and may cause leakage. Protect cylinders from objects that will cut or otherwise abrade the surface of the metal.
- (16) When testing for leaking gas cylinders, use soapy water or leak-detection compound conforming to MIL-L-25567.
- (17) Only use a gas cylinder that is properly marked (by color of paints or with the name of the gas stenciled on cylinder and valve). Return all mis-marked cylinders to the nearest Naval Supply Depot.
- (18) Work center supervisors shall ensure that supply and exhaust ventilation exists in compartments where compressed gases are stored or in use, systems are in good operating condition, and have been evaluated as adequate by an industrial hygiene survey team.
- (19) To thaw out valve outlets that are clogged with ice, use warm (not boiling) water. The use of boiling water will melt the fusible plugs, if present, and vent the cylinders.
- (20) Never discharge a cylinder into any device or equipment in which the gas will be entrapped and create pressure. The only exception is a cylinder equipped with a pressure regulator set to control the pressure.

(21) Never use oil-tolerant gases when oil-free gases are required. This practice is discouraged by the fact that valve outlets are not interchangeable. However, there have been cases in which this safety feature has been overcome by homemade adapters.

(22) Close the cylinder valve and release the gas from the regulator before the regulator is removed from a cylinder valve.

**c. Recharging Cylinders Aboard Ships**

(1) Recharge only diving air (SCUBA) cylinders, except as noted below:

- R) NOTES: 1. Small cylinders of hydrogen routinely used for nuclear propulsion plant operations may be refilled per the Reactor Plant Manual.
- A) 2. Fire extinguishers and fire extinguishing system cylinders may be recharged per NSTM 555.

(2) The charging of divers' scuba tanks from the ship's air system shall meet the purity requirements of the U.S. Navy Diving Manual, NAVSEA 0944-LP-001-9010, paragraph 5.2.1.2. Commanding officers may delete this requirement during emergency situations.

- R) (3) Recharge a cylinder only if less than 5 years have passed since its last hydrostatic test date. The only exceptions are 3A and 3AA cylinders having water capacities under 125 pounds, for which a 10-year hydrostatic test frequency is approved. For fire extinguisher and fire extinguishing system cylinder hydrostatic test requirements, see NSTM 555.

(4) Never attempt to mix gases in a cylinder. Unauthorized personnel should never refill a cylinder.

**d. Welding Cylinders**

(1) Place cylinders a safe distance away from the actual welding or cutting operation so that sparks, hot slag, or flame will not reach them. Use fire-resistant shields.

(2) Do not place cylinders where they might become part of an electric circuit. Contacts with energized equipment shall be avoided. Cylinders shall be kept away from piping systems that may be used for grounding electric circuits, such as for arc-welding machines. Any practice, such as the tapping of an electrode against a cylinder to strike an arc, is prohibited.

(3) Unless connected to a manifold, do not use oxygen from a cylinder without first attaching an oxygen regulator to the cylinder valve. Before connecting the regulator to the cylinder valve, the valve shall be opened

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slightly for an instant and then be closed. Always stand to one side of the outlet when opening the cylinder valve.

(4) Always place the fuel-gas cylinders with valve end up. Liquified gases shall be stored and shipped with the valve end up. Prior to use, acetylene cylinders must be stored in a vertical position for a minimum of 2 hours to stabilize the gas. If acetone flows from the cylinder, put aside the cylinder for an additional period. (R)

(5) Do not place anything on top of an acetylene cylinder which may damage the safety device or interfere with the quick closing of the valve.

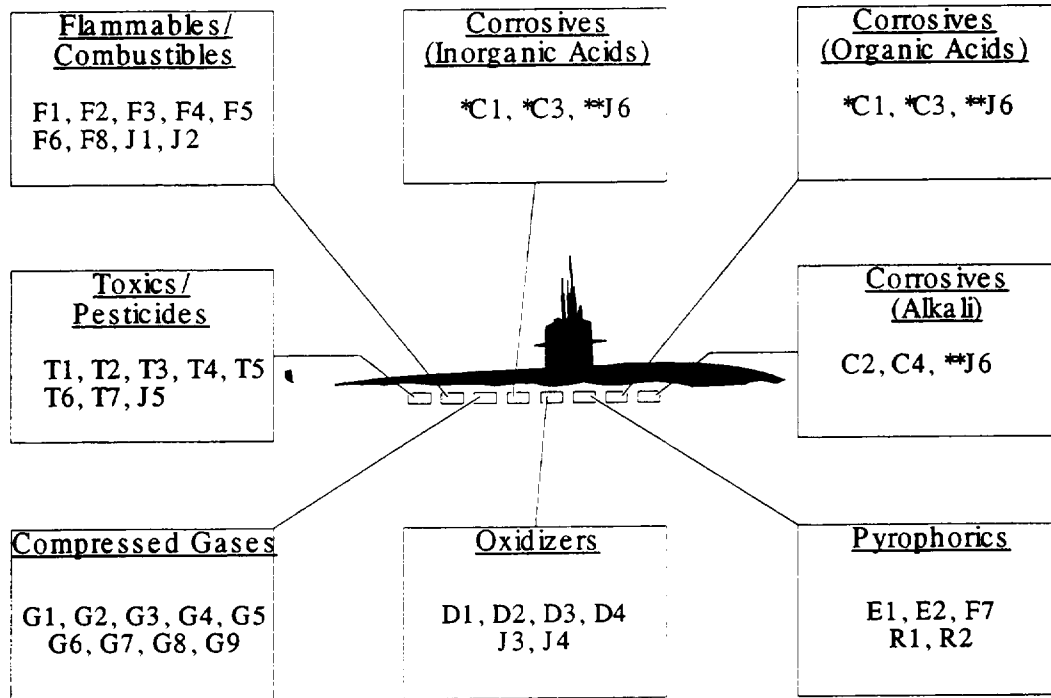
(6) Never use fuel gas from cylinders through torches or other devices equipped with shutoff valves without reducing the pressure through a regulator attached to the cylinder valve or manifold.

(7) Do not use copper tubing with acetylene gas cylinders due to the potential of an explosive chemical reaction taking place.

(8) Back off on the regulation screws, and then open the cylinder valves slowly. Open the acetylene valve one-fourth to one-half turn. This will allow an adequate flow of acetylene, and the valve can be closed quickly in an emergency (never open the acetylene cylinder valve more than one and a half turns). The oxygen cylinder valve should be opened all the way to eliminate leakage around the stem. (A)

Appendix D15-A  
**HAZARDOUS MATERIAL COMPATIBILITY STORAGE DIAGRAM**  
**(USING HMIS HAZARD CHARACTERISTIC CODE (HCC))**

The Hazardous Characteristic Code (HCC) for each SHML item can be found in the Hazardous Material Information System (HMIS). The HCC and their intended use are defined and explained in 5100.19C, Volume I, Appendix B3-E.



**Instructions**

1. Each block represents a separate stowage location. The codes in the the boxes are grouped with other codes with which they are compatible for storage. Generally, materials with different codes will not be stowed together unless specified below:

a. Inorganic acids shall be stored in a designated locker, separate from flammable materials and organic acids. (R)

b. Organic acids shall be stored in a designated locker, separate from flammable materials and inorganic acids. (R)

**NOTES:**

\*C1, C3 - HM identified with the C1 or C3 code may be either an inorganic or an organic acid. See page D15-A-2 for examples of inorganic and organic acids.

\*\* J6 - HM identified with J6 may be an inorganic acid, organic acid, or alkali. See page D15-A-2 for examples of inorganic/organic acids and alkalies.

2. Stow all aerosol containers as flammable material.

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## Appendix D15-A

ACID AND ALKALI EXAMPLES

The table below lists common examples of inorganic acid, organic acid, and alkali. Acids identified with the HCC code C1 or C3 may be either inorganic or organic, check carefully before storing. HM items with HCC code J6 may be an inorganic acid, an organic acid, or a alkali; check carefully before storing.

Inorganic acid (C1, C3, J6)	Organic acid (C1, C3, J6)	Alkali (C2, C4, J6)
Alodine Aqua fortis Boric acid Chromic acid hydrochloric acid Hydrofluoric acid Muriatic acid Nitric acid Oil of Vitriol (sulfuric acid) Orthotolidine Solution Phosphoric acid Sodium bisulfate Sulfamic acid Sulfuric acid	Acetic acid Citric acid Cresol Cresylic acid Glacial acetic acid Oxalic acid Sulfosalicylic acid Trichloroacetic acid Vinegar	Ammonia Ammonium hydroxide Barium hydroxide Calcium hydroxide Caustic soda Caustic Potash Diethylenetriamine Lithium hydroxide Monoethanolamine Morpholine Potassium carbonate Potassium Hydroxide Soda lime Sodium sulfide Sodium hydroxide Sodium metasilicate Sodium phosphate Sodium silicate Sodium hypochlorite Tetraethylenepentamine